ORIGINAL COMMUNICATIONS.

ON THE ORIGIN AND DEVELOPMENT OF THE BACILLUS
TUBERCULOSIS IN THE HUMAN LUNG, LIVER, SPLEEN,
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INTRODUCTION.

In the following pages I shall state the results of a series
of microscopical researches, which, since April, 1883, I
have made in regard to the nature of the so-called bacillus
tuberculosis of Koch, and to the true relationship of this

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* The investigations described in this treatise were commenced in the
spring of 1883, and continued to the beginning of July, 1884, by which
time the author had closely studied the lungs and other organs of twelve
or more cases of both miliary and chronic tuberculosis, besides having
elicited the principal facts concerning the relation of the bacillus tubercu-
losis to the tissues of these organs. At this time, however, his expectations
of seeing the results of these labors in print during the following winter
were dwarfed by a fresh and severe attack of his old enemy, the rheuma-
tism, which kept him confined to his couch for four long and weary
months. When, in the ensuing autumn, he was again enabled to resume
his accustomed labors, he resolved to render his observations more valuable
by the special study of the organs of about fifteen more cases of tubercu-
losis, and by devoting more time to the preparation of the treatise and the
execution of the accompanying illustrations than he had at first intended.

organism to the tissues of the human tuberculous lung, liver, spleen, etc. These researches may be regarded as a continuation of some others which I made during the summer and autumn of 1882, and the results of which were published in two articles in December, 1882, and February, 1883, in the CHICAGO MFDICAL JOURNAL AND EXAMINER.

Before, however, commencing to speak of these more recent researches on this subject, I deem it proper to present to the reader a few explanatory remarks on the statements concerning the bacillus tuberculosis of Koch, which I made in the two papers just mentioned.

It will be remembered by those who read these papers that, at that time, I failed to demonstrate the bacillus tuberculosis in sections of tuberculous lung, stained by the method which Koch had recommended in his paper, but that by treating these sections with a solution of caustic potash I discovered in the tubercles certain characteristic cells which contained, besides fat-globules and pigment-granules, numerous minute fat crystals. These crystals, representing very minute rods, so closely resembled in form minute bacilli that, as Koch had not mentioned them in his paper, they induced me to regard them as identical with the organisms which Koch had described. This error, as I have already remarked in my second paper, and as I may now repeat, would never have been committed if I had had the opportunity, before taking the above view, of actually seeing Koch's bacillus tuberculosis, or, if Koch, in naming the organism which he had discovered in human tuberculous lungs as well as in the expectorations of tuberculous patients, had considered a little closer the characteristic features of a bacillus, such as they have been defined by Cohn

in his classification of the bacteria family. I would not venture to express myself so fully on this subject if I had succeeded to see in only one instance among the thousands of these so-called bacilli tuberculosis, which I have now stained and examined in sections of tuberculous lung and in specimens of tuberculous expectoration, the features displayed which characterize the bacillus form of a bacterium. On the contrary, in every instance I found, not only the form, but all other characteristic features of a so-called spherobacterium. Instead of these organisms appearing in the form of minute rods, such as Koch has described them, they represent in reality shorter or longer filaments composed of minute granules. This granular composition of the bacillus tuberculosis of Koch was first observed by Gibbs, and published in August, 1882, in the *London Lancet*. But I must confess that my faith in the true bacillus form of the organism in question, as described by Koch himself, was at that time so great as to incline me to think that the granular filaments, mentioned by Gibbs, did not truly represent the rod-like bacillus tuberculosis of Koch. And accordingly, when I came to observe these granular filaments in tuberculous sputa, treated with a solution of caustic potash, I regarded them as the organisms mentioned by Gibbs, without ever suspecting them to be representations of the veritable bacillus tuberculosis of Koch. Guided then in microscopical examinations by the idea that the bacillus tuberculosis of Koch must show itself in the form of a minute rod, such as its name implies, it must not be wondered that, when discovering in certain degenerating cells of the tubercles minute rod-like fat crystals, which in form closely resembled minute bacilli, the idea arose in my mind

that they might be identical with Koch's bacillus tuberculosis. This idea was strengthened not only by the fact that the cells containing these crystalline pseudo-bacilli were met with in the very places where Koch had located his bacillus tuberculosis, that is, along the periphery of the tubercle and outside of the cheesy centre, but moreover by these peculiar cells never having been mentioned in his paper. In the course of this treatise I shall have opportunity to refer again to these cells, which, as far as I know at present, are not identical with the true neoplastic cells of the tubercle, but which, nevertheless, are not without signification in the histological development of this neoplasm. When finally, in January, 1883, the true bacillus tuberculosis of Koch was shown to me in a specimen of tuberculous pustum, such as I mentioned in my second paper on the subject, I found that it was identical with the granular filaments to which Gibbs had referred in his paper, I did not hesitate to acknowledge this fact.

More than three years have passed since my second paper on this subject was published, in which I notified the reader that I should take up the subject again as soon as I should have procured the proper staining material, and not rest until I should have either satisfied myself as to the existence of this pretended parasite, or at least have thrown some light upon the different forms under which it had appeared to different observers. Since that time the bacillus tuberculosis has been a common object of microscopical examination, and thousands of specimens of tuberculous sputum have been stained and examined, and numerous articles written and lectures delivered on the results of these microscopical examinations. But as they were, with a comparatively

few exceptions, chiefly made by clinicians for diagnostic pur-
poses, with the view of simply determining the presence or
absence of the bacillus tuberculosis in the lungs of their pa-
tients, no further light was thrown upon the true origin of the
organism, or upon the manner in which it gained access into
the human lungs. Nor have the hundreds of thousands of in-
oculations with tuberculous matter, hitherto made on various
kinds of animals, demonstrated anything more than the em-
pirical fact of the presence or absence of the bacillus tuber-
culosis in the lungs or other organs of the inoculated animal,
proving simply the transferability of tuberculosis from one
animal to the other. The study of this minute, apparently
parasitic organism in the human lungs, the most important
locality where it is met with, appears to have been greatly
neglected. Those investigators, even, who studied this
organism in the tissues of these organs, appeared to have
cared mainly to satisfy themselves as to its presence or ab-
sence in the latter, for, if their histological labors had been
carried on more closely, they would not have failed to ob-
serve certain facts which closely bear on the nature and de-
velopment, and even origin, of these bacteria, and which in
the following pages, will form the chief part of my subject.

From the remarks just made it may then be inferred that
while much has been done, since Koch first announced his
discovery of the bacillus tuberculosis, by way of clinical obser-
vation and experimental pathology, to solve the so-called
bacillus tuberculosis question, the microscopical research in
the field of pathological anatomy has, to the extent of my
knowledge, rather been neglected. The reason for this
negligence, however, may be easily found in considering that
the material for clinical observations, as well as for experimen-

tal pathology, is more abundant and more easily obtained than that required for extensive and thorough microscopical researches in pathological anatomy. Every medical practitioner meets with cases of tuberculosis in his daily practice, and as the preparing and staining, as well as the microscopical examination of a little tuberculous sputum, does not require extraordinary skill, nor consume much time, he will have sufficient opportunity of making his own clinical observations on the subject,—while, on the other hand, the material required for extensive investigations in pathological anatomy can only be obtained in connection with the pathological departments of large hospitals. Thus it has happened that so many thousands of specimens of tuberculous sputum have hitherto been examined and discussed in medical societies and journals, while more extensive microscopical studies of thin sections of tuberculous lung, or other organs, have thus far only been made by a comparatively very small number of investigators.

My own labors relating to the bacillus tuberculosis were closely confined to the field of pathological anatomy, for the reason that in this field I am in every respect prepared to do justice to the subject,—not only as regards the abundant fresh pathological material constantly at my disposal, but moreover as regards the proper outfit and assistance for the making of accurate and extensive histological researches. As regards the optical instruments which I use, I may say that during these last twenty-six years I have worked exclusively with first class objectives of the best makers, but especially with those made by the late Mr. Tolles, while the microscopical stands which I have used represent the large patterns made by Mr. Joseph Zentmayer, and constructed for the adaptation of any accessory optical appliance that can facilitate and per-

fect microscopical examinations. I may state that I have com-
plied with Koch's demand in pursuing my special studies of
the bacillus tuberculosis with the assistance of a $\frac{1}{10}$ inch homo-
geneous immersion objective, which, in the summer of 1884,
Mr. R. Tolles made for me for this special work. This objec-
tive, constructed not for the purpose of resolving the fine
lines of diatoms, but for histological work, with a view of
obtaining penetration and perfect definition, is, from what I
know, if I may be allowed to say in honor of its maker, the
equal to any other objective hitherto made. Besides this ob-
jective I also made use of Abbe's illuminating apparatus, which
Mr. Zentmayer had adapted to my microscope. Both this
apparatus and the homogeneous immersion objective, though
they are not absolutely essential, I have reason to say with
Koch greatly facilitate an accurate study of the bacillus
tuberculosis and its relations. In my own case they proved
of great service in confirming the correctness of the observa-
tions which I had previously made with dry or water immer-
sion objectives, and a Powel and Lecland's homogeneous
achromatic condenser.

In order to properly understand the question of living
germs of disease, it is necessary that the reader should be
familiar, to a certain extent, with the exact definition of the
different forms of bacteria upon which the classification of
these organisms is based. Unfortunately the great majority of
practicing physicians are unacquainted with the difference of
form, or other characteristic features, existing between these
minute organisms, which by many physicians are regarded as
the original cause of a now considerable number of diseases :
for, as they look upon these beings only from a practical point
of view, it matters to them very little whether the living germ
appears in the form of a sphero-bacterium, or in that of a

bacillus. To them the monas tuberculosis of Klebs, the micrococcus tuberculosis of Toussaint and the bacillus tuberculosis of Koch are one and the same in point of signification, as all three have been presented to them as the original cause of tuberculosis. And it is not improbable that the practical physician, in confounding these forms with one another, has come nearer to the truth than the speculating and theorizing bacteriologist. Nevertheless, in treating our subject more philosophically and from a pathological point of view, it is very important that we should be precise in the terms we use and see that they closely correspond with the true definition of the object in question. For this reason, I shall, before proceeding to the description of my observations, make a few passing remarks on the morphological characters of the different kinds of bacteria and their transformation from one form into another.

Although several attempts have been made by divers naturalists to arrange the different kinds of bacteria (Schizomycetes, cleft fungi) according to their form, or other prominent characters, into a number of systematic groups, no perfect classification of these organisms has hitherto been attained. The reason of this failure is to be found in the want of permanency in the various forms under which the bacteria, such as they occur in nature, present themselves to the eye of the observer. The classification which has been most generally used, on account of its convenience for practical purposes, and which for this reason I have formally followed myself, is that of Cohn. It is chiefly based upon the morphological character of the organisms concerned, and consists of the following four groups : 1, *Spherobacteria*, appearing in the form of minute spherical, or oval, cells, the diameter of which is generally less than 0.00 mill. They either appear singly or

adhering to one another in pairs, or in chains, formed by a smaller or greater number of cells. When their multiplication by the division of the individual cells becomes very active, they aggregate into masses, or colonies, generally called "zoglœa," which are embedded in a gelatinous material, secreted by the cells. This group embraces but one genus, that of *micrococcus*; 2, *Microbacteria*, embracing, in a narrow sense, the single genus *Bacterium*, represented by short cylindrical, or elliptical cells, which also hang together in pairs. They very rarely appear in the form of chains, though they are met with in the form of zoglœa with abundant intercellular substance; 3, *Desmobacteria*, represented by straight cylindrical cells, usually much longer than wide. They occur isolated, but are usually united in chains. While some of them exhibit active spontaneous movements, others appear motionless. They are represented by the genera *Bacillus* and *Vibrio;* 4, *Spirobacteria*, appearing in the form of cylindrical cells, generally several times as long as wide, and spirally around, similar to a corkscrew. They embrace the genera *Spirillum* and *Spirochæte.* There are a number of other genera of the cleft fungi which, however, may be passed over for the sake of brevity.

When Cohn conceived the above classification of the bacteria, he regarded each of these forms as a distinct seperate genus, the individuals of which would under all circumstances not only reproduce the same forms, but be also endowed with the same physiological properties. In accordance with this view, germ theorists attributed a specific property of producing one or the other specific disease to each form of pathogenic bacteria. More recent investigations, however, have shown that this view is erroneous, and that the forms and other characters of these genera are by no means permanently fixed, but that,

on the contrary, one form may, in the course of development, be converted into another. Thus, a bacillus may be developed from a micrococcus, and finally divide again into smaller cells to reassume the micrococcus form. The idea of different forms of bacteria representing but different phases of development of a single natural germ was already advanced, more than ten years ago, by Billroth and some other mycologists; but it was particularly upheld by Nägeli, who pointed out the probability that the various forms, under which the schyzomycetes, or cleft fungi, present themselves, might actually represent but a few natural genera. Nägeli's view that not only the forms of the bacteria, but also their physiological properties, may be altered by artificial cultivation in different nutritive media, was subsequently corroborated by the interesting experiments of Hans Buchner, which experiments, as far as I am able to judge from the perusal of his writings, were made with accuracy, necessary precautions and perseverance. These consisted principally in the conversion of the so-called infectious *bacillus anthracis* into the harmless, non-infectious hay-bacillus, or *bacillus subtilis.* This conversion Buchner effected by supplying the former very freely with oxygen during its cultivation, first in a solution of Liebig's extract of meat, pepton and sugar and afterwards in an infusion of hay. These cultivations were carried through 1,500 generations of the fungus in a space of six months. On the other hand, Buchner converted the non-infectious hay-bacillus, such as it occurs in nature, into the infectious bacillus anthracis by cultivating it, first in egg-albumen and solution of meat extract, and then finishing the cultivation in fresh blood taken from rabbits. He furthermore demonstrated very closely the changes taking place in the form of the bacteria; that is, in the length and width of their individual cells or joints, when cultivated in different nutritive

substances.   The results which Buchner obtained from his
experiments, concerning the convertibility of infectious into
non-infectious bacteria, and *vice versa*, and which so conclu-
sively confirmed Nägeli's views regarding the constancy or
inconstancy of the forms and physiological properties of these
organisms, were, as ought to have been expected, severely
criticised by those mycologists who upheld the theory of the
specificity of form and property, among whom were Koch and
his followers.   But the arguments, directed by Koch himself,
against the trustworthiness of Buchner's investigations, and
calculated to invalidate the facts brought to light by the labors
of this investigator, were answered by Buchner in a lengthy
but very able treatise, in which, by reviewing and analyzing,
in a clear, scientific style, every single point in the charges made
against his method of investigation, he deprived the arguments
of his opponents of every trace of foundation.

The investigations of Buchner were followed by a series of
others, made by Zopf on the highest developed forms of the
cleft fungi, viz., Cladothrix, Crenothrix and Beggiatoa, the re-
sults of which fully corroborated the view held by Billroth,
Nägeli, Buchner, and others.   The investigations of Zopf con-
sisted in carefully cultivating the named genera of schizomyce-
tes for the purpose of obtaining each individual germ in a pure
condition; that is, isolated from individuals belonging to another
genus, or species.   The numerous microscopical examinations,
made of the fungi concerned during their development, showed
him that not only micrococci would grow into bacilli, or the
latter be converted into the former, but that even the sword
and screw-like forms of the spirilla and spirochæte would ap-
pear in one and the same genus during the course of develop-
ment.   The interesting and important results which Zopf ob-
tained from his extensive researches into the development of

the cleft fungi and cleft algæ, were published by him in the form of a treatise, fully illustrated by seven beautifully executed lithographic plates * Subsequently to this treatise he published another on the cleft fungi in particular,† in which he treats in a systematic style of the history, anatomy and classification of these organisms. In this little work the subject is treated from the most recent standpoint, based upon the latest observations on the schizomycetes. I do not hesitate to say that I have gained from this little work more definite and positive information, as regards the morphology and nature of bacteria, than from all other works and treatises on the subject I had previously read. Not only this, but certain phenomena which I had observed on different occasions, and for which I was unable to find a satisfactory explanation in other works, were rendered clear to me by the writings of Zopf. These phenomena I observed with bacteria contained in urine, and, as they relate to the subject, I may here briefly state some of them. Bacteria, as is generally known, are very often met with in pathological urine, into which, it is commonly believed, they gain access from the surrounding air, after this fluid has been voided from the bladder. This is probably true in most instances, though, sometimes, I have suspected the reverse, and, in one particular case, in which these organisms were observed in the urine in very great numbers, I convinced myself of their being present in this fluid before its leaving the bladder, by microsopically examining it directly after it was voided. At any rate, from what I know from the numerous

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* Zopf. Zur Morphologie der Spaltpflanzen. (Spaltpilze und Spaltal. gen.) Verlag von Veit & Comp. Leipzig, 1882.

† Zopf, "Die Spaltpilze."—Nach dem neuesten Standpunkte bearbeitet. Separatabdruck aus der Encyklopædie der Naturwissenschaften. Verlag von Eduard Trewendt, 1883.

specimens of pathological urine which are daily microscopically examined under my supervision at the pathological laboratory of the Charity Hospital, the number of these organisms varies very greatly in the different specimens of urine, collected at one and the same morning, for, while some may be met with in one specimen, and a small number only in the second, they may appear in very great numbers in the third. This fact, which I have observed for years, shows that the absence, or presence in greater or lesser number of the bacteria in the urine, stand in some relationship to the particular condition or constitution of this fluid. The bacterium generally met with is a small micrococcus (fig. 2 *a*) to which the name *micrococcus urinæ* has been applied, though, as it appears to me, it hardly differs in form from those bacteria generally met with in putrefactive liquids. The filaments of the ordinary urine bacteria are straight, and exhibit spontaneous movements. In many specimens of urine, however, a small number of another form of bacteria is met with, the individual filaments of which are seen scattered among the more numerous regular urine bacteria. These (fig. 2 *b*) are distinguished from the latter by their cells being slightly larger and adhering but very loosely to one another, making them appear like rows of beads; they are, moreover, slightly curved, and exhibit no spontaneous movements, resembling, on the whole, the filaments of mycoderma aceti. About two years ago I met these torula-form bacteria in very great numbers in a specimen of albuminous urine, in which the number of the regular urine-bacteria was so small as to be hardly noticed. Desiring to know the ultimate fate of the former I kept this urine for a further study. In re-examining it, accordingly, on the next day, I found these torula-form bacteria considerably increased in number, and, furthermore, that many of them had grown into long filaments (fig.

2 *c.*); on the third day these were also found to have very considerably increased in number.   Subsequent microscopical examination revealed another kind of cells (fig. 2 *d*, and *e.*), which appeared to have arisen from the long bacterial filaments, as the bottle containing the urine had remained closed.   These last cells appeared to represent true torulæ, multiplying, as the drawing shows, both by budding and by cell-division.   A final examination, made some days afterward, showed another formation consisting in a number of long filaments, probably representing gelatinous envelopes, in which a number of small groups of micrococci (fig. 2 *f.*) were observed embedded.   It is not improbable that these groups of micrococci originated by the breaking up of larger cells, such as Zopf observed in his investigations.

The above stated observations, which I made on the transformation of bacteria in urine, are too imperfect in themselves to sustain my particular theory, though they are sufficiently correct to corroborate to a certain extent the observations of Zopf and others.   My principal object in mentioning them in this place, however, was not to attempt a corroboration of the facts observed by others, but rather to show that valuable information regarding the nature of bacteria may even be gained by casual observations made on these organisms when met with in those liquids in which they naturally occur.   A thorough investigation of the whole subject, of course, cannot be made without having recourse to artificial cultivation,—a laborious task, for which I have never had the necessary time and convenience at my disposal.

From what I have said in the foregoing pages, then, we may safely infer that the metamorphosis of one form of

bacteria into the other, first pointed out a number of years ago by Billroth and Nägeli, has been proved finally by the labors of Cienkowski, Nealson, Buchner and Zopf to be a fact. The important bearing of this fact on the artificial cultivation of pathogenic bacteria, and with it on the whole question of living disease germs is obvious, as it shows the possibility of changing the form in which these bacteria in reality exist in the human organism, by transferring them to another nutritive substratum.   While thus, for instance, the so-called bacillus tuberculosis may exist in the human lungs in the form of a micrococcus, it may be developed into a rod or bacillus form, when artifically cultivated in another nutritive medium.

Having by the foregoing introductory remarks prepared the reader for a better appreciation of the results of my recent investigations concerning the nature of the bacillus' tuberculosis, and its relationship to the human lungs and other organs, and for the conclusions which may be drawn therefrom, I shall pass over to the description and discussion of my observations.

II.

REMARKS ON THE STAINING OF BACTERIA.

In connection with the demonstration of the bacillus tuberculosis in the thousands of specimens of tuberculosis expectoration, to which I have already referred, a great deal has been said and written on the comparative merits of the different methods for successfully staining this bacterium, and we are justified in presuming that, at the present time, most physicians are familiar with this subject.   For this reason I might confine my remarks concerning the staining of thin sec-

tions of tuberculous tissue, as well as of tuberculous sputum, to a simple statement of the particular method which I employed, if there were not observed in the different anatomical elements of the tisues certain differences in the degree of staining, which demand a more extended discussion of this subject.

It may be safely asserted that in the special study of pathogenic bacteria the process of staining these organisms plays a most essential part, as it is alone by this process that their presence, as well as their comparative number in the tissues of one or the other organ can be safely determined. When the sections of tissues containing bacteria are very thin and treated with solutions of caustic potassa or soda, the organisms may under favorable circumstances be distinguished by a practiced eye from the tissues in which they are buried, though, at the same time, the chances of failure are sufficiently great to render this mode of preparation unreliable for a thorough study of the subject. Besides, in order to determine safely the presence of bacteria in sections of tissue by the aid of these solutions, the organisms should be present in considerable numbers, as, otherwise, they are very apt to escape observation on account of their resemblance to organic granules, or even to very minute fat globules. I, therefore, cannot but fully endorse the importance which Koch has attached to the staining of his bacillus tuberculosis for determining its presence in tuberculous tissues. The demonstration of certain points concerning the origin and development of these bacteria in the human lungs and other organs, which I observed in the course of my recent investigations, likewise depend upon a perfect staining of the tissues under examination.

When Koch first announced the discovery of his bacillus tuberculosis he claimed as one of the specific properties of this organism the capacity for retaining the aniline color by which it has been stained, in preference to any other color to which it may be subsequently exposed. Thus, if the bacillus has been stained in an alkaline solution of methyl blue—the original solution which Koch used—it would afterward refuse to absorb a concentrated watery solution of vesuvin, whilst all other bacteria, with the exception of the bacillus lepræ, would give up the methyl blue and absorb the brown color of the vesuvin.

This specific property, however, the bacillus tuberculosis only possesses to a limited degree, that is, as long as the animal tissues, in which it is lodged, have not absorbed the second stain; for as soon as these tissues are saturated and stained by the solution of vesuvin, the bacillus likewise will, at the expense of the blue, absorb the brown, though perhaps not as readily as the animal tissues. The failures which I experienced, when in 1882 I first attempted to stain the bacillus tuberculosis by Koch's original method, were due to my ignorance of this fact, for leaving, according to Koch's directions, my sections of tuberculosis lung fifteen minutes in the concentrated solution of vesuvin, I might have expected that every bacillus tuberculosis contained in the sections would be colored brown. But my faith in Koch's directions was so great at that time as to regard the keeping of the sections in the solution of vesuvin for not less than fifteen minutes as the proper test for distinguishing the bacillus tuberculosis from other bacteria. When, in the spring of 1883, I had succeeded in perfectly staining this organism by the superior methods of Ehrlich and Gibbes, and by continued practice gained some

experience in the staining of bacteria, I recognized the causes
of my former failure.   But, being at this time familiar with the
appearance of the genuine bacillus tuberculosis of Koch, and
remembering that its discovery had been effected by means of
the original method of staining of this investigator, I resolved
to inquire, at some convenient time, once more into the merits
of this method of staining.   Accordingly, during the spring
of 1884, I put a number of very thin sections of tuberculous
lung containing, as I knew from previous stainings with Gibbes'
solution of magenta, considerable numbers of bacilli tubercu-
losis, in Koch's original alkaline solution of methyl blue, and,
after having left them there for twenty-four hours, transferred
them to a concentrated watery solution of vesuvin.   Already,
after the lapse of a few minutes, these sections had assumed a
dark, dirty, greenish-brown color, which, resisting the action
of water or alcohol, had rendered them unfit for examination.
As there exist some differences in the aniline preparations,
even in those of the same color, and especially in the blue, I
came to the conclusion that my methyl blue was not of the
same kind as that which Koch had used for his staining, and
therefore I made, according to Koch's formula, a fresh solu-
tion which I colored with methyl violet.   But instead of leav-
ing the sections twenty-four hours in this staining fluid I
warmed the latter, such as Koch had also recommended.
When perfectly stained the sections were transferred to a con-
centrated watery solution of vesuvin, in which, however, they
were only left three minutes.   After their removal from the
latter solution they were washed in water, then successively
treated with absolute alcohol and oil of cloves, in order to be
finally mounted in Canada balsam.   The subsequent micro-
scopical examination showed but a very few blue colored
bacilli tuberculosis in the sections ; the rest had become in-

visible by having absorbed the vesuvin and thus assumed the same color as the tissue in which they were buried. Therefore, then, I stained another set of sections with the same solution, which, however, had been rendered somewhat stronger by the addition of a little more methyl violet. After having been stained in this solution, the sections were washed in water, and individually treated with the solution of vesuvin. In doing so, I first left each section half a minute in the solution of vesuvin after which it was washed in water and then, for about half a minute, put in alcohol for the purpose of removing that portion of the vesuvin which in all Canada balsam mountings is removed from the sections by the action of absolute alcohol and oil of cloves, with which they are previously treated. From the alcohol the sections were then taken, immersed in water and examined by the aid of a strong loupe, in order to ascertain whether some of the blue staining was still remaining. When this was the case the section was replaced in the solution of vesuvin for one-fourth or one-half minute longer, until, with the exception of a few small bluish spots, it was colored brown throughout. The microscopical examinations of these sections, after mounting in Canada balsam, showed that these bluish spots were produced by numerous bacilli tuberculosis, stained blue by the methyl violet. The same results were obtained when, instead of the sections, tuberculous sputum was stained by this method.

The above described experiments with Koch's original bacteria staining fluid conclusively showed me that the bacillus tuberculosis has no claim for the specific property of successfully resisting the displacement of one aniline color, which it had once absorbed, if subsequently exposed to another color. I can not forbear to think, therefore, that I might, perhaps, have been more successful in my first attempts to stain the

bacillus tuberculosis by Koch's original method, in 1882, if I had not so closely followed his own directions; though I do not mean to imply that these directions were entirely wrong, as it is possible that the vesuvin which Koch used for his staining may have differed from that which I obtained, by being less soluble in water.

The original method of Koch for staining bacteria by alkaline liquids has been, to the extent of my knowledge, generally abandoned on account of its being inferior to other methods, particularly to those of Ehrlich and Gibbes. The methyl violet and vesuvin, also, are, for the want of sufficient transparency, inferior to magenta followed by chrysoidin or Bismarck brown, and therefore not suited for accurate research. Nor is the methyl violet sufficiently durable, for when the sections, stained by Koch's method, as above described, were re-examined about two weeks afterwards under the microscope, it was found that the bacilli had completely faded; the methyl violet, by which they had been stained, was observed to be diffused throughout all the surrounding tissue.

The bacillus tuberculosis, as is now generally known, may be successfully stained by other methods and staining liquids, described by various authors. A number of these I have used myself, but as they all have been commented on by other writers, I shall confine my further remarks on the subject of staining these bacilli to those particular methods which I have finally preferred for my investigations. Of these I may first mention the original method of Ehrlich, in which the aniline oil plays a prominent part. The bacillus tuberculosis, especially when present in tuberculous expectoration, may be successfully stained by Ehrlich's original staining fluid; if there is any disadvantage attending the

staining with this fluid, it is its want of permanency, as the bacilli stained by it are liable to fade soon afterward. It is for this reason that I prefer, especially for staining sections of tuberculous tissue, the staining fluid recommended by Gibbes, which in reality is a modification of Ehrlich's, but which, by the alcohol it contains, is capable of holding a greater quantity of aniline oil in solution, while at the same time it is rendered stronger by containing more of the aniline color. This fluid saturates, so to say, the bacteria with color, and thus postpones their fading to a more distant time; for, as far as I am able to judge by experience, the permanency of the staining is proportionate to the quantity of coloring material absorbed by the bacteria. As regards the particular aniline color to be used for the staining, I prefer the magenta, though I have also had very good results with the hydrochloride of rosaniline, or with the methyl violet. While the rosaniline, however, is too light a color for being readily distinguished under the microscope, especially when the organisms are deeply buried in the tissues, the methyl violet has the disadvantage of being not sufficiently transparent and of being too easily dissolved by the absolute alcohol used for dehydrating the sections before mounting in Canada balsam. Thus is may happen that the organisms, though well stained by the methyl violet at first, may appear but faintly or not at all stained after being mounted in Canada balsam. The magenta, therefore, being sufficiently transparent and, from all I know, one of the most stable of the aniline colors generally used, is more suitable for an accurate study of the bacillus tuberculosis and for a permanent mounting of the sections. For the purpose in view, however, it must be of the best quality. The kind which I use is recog-

nized by its solution presenting a purple color, while another inferior kind presents a more scarlet red. The bacilli tuberculosis stained with the former solution present, also, when examined with daylight, a purple color, while those stained with the latter—that is if stained at all—appear more of a scarlet red.

Though I have generally preferred Gibbes' solution for the staining of my sections, I have not always used it in its original strength. In its full strength, such as is expressed by the original formula, this solution is intended for staining the bacillus tuberculosis in a comparatively very short time, according to Gibbes' directions in one-half hour. With this solution the bacteria, whether contained in tuberculous expectoration or in tuberculous tissues, may be very readily stained, for which reason it is very convenient in many cases. In order, however, to stain the bacillus tuberculosis, especially when contained in tuberculous tissues, in a more thorough and permanent manner, I have found it of greater advantage to leave the sections for a longer time in the staining fluid. But as Gibbes' solution, made after the original formula, contains rather too much of the magenta for this purpose, I have, for the staining of my sections, reduced it in strength by taking only one-half of the quantity of magenta put down in the formula. In this modified staining fluid of Gibbes the sections may be left for twenty hours, or even longer. If the weather is very warm, it may happen that during this time the solution is rendered stronger by the evaporation of the alcohol, and that a surplus of the aniline color is found to adhere to the sections, while these, themselves, appear somewhat shrunk in their extent. In cold weather the staining fluid containing the sections may, on the contrary, be slightly

warmed on a sand-bath, until a delicate vapor is observed to arise from the surface of the fluid, after which the flame is extinguished, and the sections left to cool off with the sand. When the sections are removed from the staining fluid, they are put in distilled water and left there as long as it will remove any surplus aniline color contained in them; they will then appear soft and pliable and not diminished in size. But if, as I have already remarked, too much of the aniline color—in the present case the magenta—is found to adhere to the sections, while they themselves have shrunk in size, no attempt should be made to put them in this condition in the nitric acid solution for the purpose of discoloring them, as this solution is not capable of removing entirely the surplus aniline, nor of rendering the section again soft and pliable, or of making it expand to its original size.   The sections, when in this condition, should be placed in alcohol, which easily removes the surplus of the aniline color without injuring the tissues; as soon, however, as this surplus is removed, perhaps in one-half or one minute, they are transferred from the alcohol into distilled water, in which they will be found to expand to their original size, and from which they may now be transferred to the solution of nitric acid.

In treating the sections with the solution of nitric acid— one part of the acid to two parts of water—as first recommended by Ehrlich, some caution has to be observed, for the reason that, if left too long a time in this solution, the nitric acid will in most cases not only remove the stain of the aniline color from the animal tissues, but also from the bacilli tuberculosis.   For my own part, I generally leave the sections in the nitric acid solution *only as long* as they are ob-

served to emit a brown precipitate.   As soon as the formation of this precipitate ceases, I quickly transfer the sections
from the nitric acid solution to the water, in which they may
be noticed to part with some of the magenta previously absorbed and which here presents a purple tint.   If the sections are now transferred to clean water and made to rest
on a white ground, they still appear colored to a certain
extent by the magenta, so that one might be tempted to
treat them once more with the nitric acid solution, until
they are completely discolored.   The error committed in
pursuing this course, however, becomes evident by taking
into consideration that the absolute alcohol, to the action of
which the sections must be necessarily exposed in order to
be rendered fit for being mounted in Canada balsam, always dissolves and removes a certain part of the aniline
color left in the sections by the nitric acid solution.   In
most cases, therefore, in which the sections have been completely discolored by the nitric acid, very few or no bacilli
will be detected in them after being mounted in Canada
balsam.

But as it is desirable to know, before mounting the sections in Canada balsam, whether they may be expected to
contain stained bacilli tuberculosis, I expose them at once,
and before they are stained with the second color, to the
action of alcohol.   If after this process the sections still
show purplish spots, when examined upon a white ground
in water, we may be sure of the presence of stained bacilli
and, moreover, that they will no more be discolored by the
subsequent action of absolute alcohol, to which they must
necessarily be exposed before they can be mounted in Canada balsam.   The same course is pursued after the sections

have been stained with the second aniline color, be it chrys-
oidin or Bismarck brown, for, as in the case of magenta, a
part of these colors is also lost by the action of the absolute
alcohol; while in observing the precaution just mentioned
the sections, if not sufficiently stained, may without much
inconvenience be replaced in one or the other of these
colors, in order to absorb them to the proper degree. For
staining the tissues of the sections I prefer Bismarck brown
or chrysoidin, for the reason that they are more transparent
than vesuvin or methyl blue and therefore better suited for
special studies of the bacillus tuberculosis; besides the con-
trast formed by these colors with the magenta purple of the
bacilli is quite sufficient for readily distinguishing these or-
ganisms from the tissues containing them.   As the length
of time for the sections to remain in Bismarck brown or
any other color depends, of course, on the strength of the
solution it, is difficult to fix exact rules on this point.   Each
student engaged in the study of tuberculous sections, there-
fore, should himself determine the time with the aid of his
watch, by removing and replacing at certain intervals of
time the sections from the staining fluid in order to wash
and examine them in water, until the are sufficiently stained;
if they remain too long in this fluid the bacilli will, in most
instances, also be colored brown.

In the foregoing description of the method which I have
generally pursued in staining the bacillus tuberculosis in
sections of tuberculous tissues, I have only mentioned the
nitric acid solution for decolorizing the animal tissues of
these sections.   Although this solution answers very well
the purpose in view, there is, nevertheless, a considerable
disadvantage associated with its action, consisting in the

contraction or shrinking of the sections, which renders them less fit for histological studies. In order to avoid this shrinking of the tissues I have had, in many instances, recourse to one of the other agents known to dissolve the aniline color, contained in the fluid, quite as well as the nitric acid. Of these agents I have particularly made use of the formic acid, first recommended, if I remember rightly, by Watson Cheyne. This acid removes the magenta only from the animal tissues, without in the least degree affecting the stained bacilli; the sections, therefore, can be left in it for several minutes without fear of discoloring them too much; the principal advanage in using this acid, however, is that it does not cause the animal tissues to shrink.

With the modification of Gibbes' solution and in the manner described above I have now not only successfully stained many hundreds of sections of the tuberculous tissue and of specimens of tuberculous expectoration, but also various kinds of liquids and infusions containing other bacteria, as, for instance, those met with in urine. The bacteria contained in these liquids were stained as thoroughly as the bacilli tuberculosis. They have retained their color remarkably well, as in some of my preparations, which were stained two years ago, they can still be distinctly seen. The bacilli tuberculosis contained in sections of tuberculous tissue, if thoroughly stained with the magenta solution will also retain the color a long time, almost for a year or even longer.

The bacteria contained in urine or other liquids may be very easily stained in the following manner: a drop of the liquid is put upon a cover-glass and then left to evaporate upon a sand-bath; upon this one or more drops are suc-

cessively applied and dried in the same manner, until the
organic matters contained in the liquid are sufficiently thick
for the purpose of staining. But as the stratum thus
formed by these matters does not protect the bacteria en-
closed within from the action of the nitric acid solution to
such an extent as the animal tissues of a section of some
tuberculous organ protect the bacilli tuberculosis therein,
the cover-glass holding the stratum should be exposed to
the action of the nitric acid solution but for a very short
time, as otherwise the latter will destroy the aniline color
previously absorbed by the bacteria.

Before closing my remarks on the process of staining the
bacillus tuberculosis I must point to some important facts
which relate to the staining of some of the individual ana-
tomical elements of the tuberculous tissues, and to which I
will have occasion to refer when discussing in the following
pages my observations on the nature and origin of the
bacillus tuberculosis.

At present it appears to be generally known that in the
different individual anatomical elements, of which all ani-
mal tissues are composed, there exists a considerable differ-
ence in the capacity of absorbing coloring matters, such as
carmine, hæmatoxylin, etc.; it is thus that the protoplasm of
the nuclei absorbs the coloring matter of a staining fluid
more readily than that of the cells themselves. This differ-
ence in the degree of absorbing coloring materials may
also be observed when a tissue passes from a normal into a
pathological condition, a phenomenon to which I have already
referred several years ago. Thus the protoplasm of an an-
imal cell or that of its nucleus will absorb and retain the
coloring material much better when in a state of irritation

than when in its normal condition. The same may be said of neoplastic cells absorbing better than the normal cells of old tissues; accordingly in staining a section of a cancerous organ the cancer cells will be found more highly stained than those of the neighbouring healthy tissue. Pathological products, such as fibrinous exudates, the albuminous cylinders met with in the urine of cases of parenchymatous nephritis, etc., also absorb coloring matter in a high degree. In staining with aniline colors vegetable or animal tissues, similar differences are observed in the anatomical elements of these tissues, not only in the degree of power for absorbing the colors, but moreover in that for retaining them. Such an instance we observe in the staining of tuberculous tissues in which the vegetable organisms, the bacteria, retain one aniline color if once thoroughly absorbed better than the animal tissues against a second color subsequently presented to them, while the latter on their part possess a greater power of absorption. Next to the bacteria, it is the nuclei of the tubercle cells which hold the aniline color, once absorbed, against the action of the nitric acid solution, or formic acid, alcohol, etc., as well as against a second color presented to them. This phenomenon manifested by the nuclei of the neoplastic tubercle cells is so constantly observed in sections of tuberculous tissues as to become a reliable test between these nuclei and those of the neighboring normal cells. This difference in the power of retaining the aniline color, however, is not only observed to exist between the nuclei of the tubercle and those of the normal cells, but, moreover, between the nuclei of the individual tubercle cells themselves. In a section of a tubercle, stained with magenta, and discolored with nitric acid solu-

tion or formic acid, therefore, a number of nuclei will always be observed to have more or less retained the magenta, while others have lost it. The retention of the staining material by these nuclei indicates the state of irritation which generally precedes that of degeneration. As soon, however, as the nuclei commence to degenerate, their absorbing power diminishes in a degree corresponding to that of the degenerating process, to be lost entirely with the final disintegration of the nuclear protoplasm.

Although the nuclei of the tubercle cells, when in a state of irritation, hold the magenta which they have absorbed against the action of the nitric acid solution, formic acid, etc., they never do it in the same degree as the bacilli tuberculosis. This is readily seen by comparing the particular tint of the magenta which the nuclei present with that of the bacilli tuberculosis; for while the latter, when thoroughly stained and examined microscopically with a daylight illumination, present a distinct purplish color, the former appear not only paler but also of a more reddish tint.

The foregoing remarks concerning the capacity of the nuclei of the tubercle cells to hold, when in a certain condition, the magenta absorbed against the action of nitric or formic acid, I have principally made for directing already in this place the attention of the reader to these facts upon which, as I shall show hereafter, the interpretation of certain phenomena relating to the origin and nature of the bacillus tuberculosis in human organs is based.

III.

THE MORPHOLOGICAL CHARACTERS OF THE BACILLUS TUBER-CULOSIS.

In order to fully understand my observations regarding the origin and the development of the so-called bacillus tuberculosis met with in human organs and its relationship to the tubercles, the reader should be familiar with the morphological character of this organism, such as they have appeared to me in the course of my microscopical investigations.

In the study of the morphological characters of the bacillus tuberculosis it is important that these organisms should not be obscured by the substance in which they are found embedded. For this reason thoroughly stained specimens of tuberculosis expectoration containing the bacilli are preferable to sections of tuberculosis lung or other organs; though these, if very thin, also answer the purpose. In examining such a specimen of sputum containing numerous bacilli tuberculosis it will be found that they represent shorter or longer filaments which are distinctly composed of minute granules (fig. 1, *a* and *b*). The number of the latter being proportionate to the length of the filament, ranges from two to six, seldom more. While some of these filaments are straight, others, perhaps the greater number, appear slightly curved, presenting in many instances one or two angular bends. In examining, especially on the longer filaments, these curves and bends a little more closely, it will be found that in most instances they occur between two neighboring pairs of granules, suggesting the idea that the whole filament is composed of pairs of granules or diplococci (Billroth). In some instances the original building up of the filaments by diplococci is very striking (fig. 1) and cannot be mistaken. The same angular bends may

even be observed on some of the shorter filaments composed only of two diplococci; sometimes even one diplococcus appears to overlap the other (fig. 1, *b*). These angular bends appear to indicate the place where two diplococci have formed a junction by mutual attraction.

Now as regards this apparent building up of the filaments of the bacillus tuberculosis by so-called diplococci, we may point to the fact that all sphero-bacteria or micrococci, such as they are met with in various natural liquids, are artificial infusions when they appear in the form of filaments, are in the same manner built up of pairs of minute cells. Generally these filaments are formed of only two diplococci, comprising two granules; not infrequently, however, the latter by joining one another give rise to shorter or longer chains, of which they themselves represent the individual joints. The building up of these chains by micrococcus filaments and of the latter by diplococci may be easily observed in that form of bacteria generally met with in urine (fig. 2, *a*).

In many specimens of tuberculous expectoration (fig. 1, *a*), but particularly in sections of tubercles undergoing the cheesy metamorphosis or so-called coagulation necrosis (figs. 4, 5, 8 and 9), the bacillus tuberculosis presents itself in the form of groups composed of a larger or smaller number of filaments, which, differing in length, frequently overlie one another in different directions. This peculiar grouping has been mentioned by other authors, but to the extent of my knowledge none of them have ever offered a satisfactory explanation for this phenomenon. As the manner in which these groups of bacilli tuberculosis are formed stands in a certain relation with other facts elicited in my investigations, I shall postpone the remarks which I have to make on this subject to another part of the treatise.

The particular appearance which these minute cells, composing the filaments of the bacilli tuberculosis, present to the eye of the observer, differs, as I have observed, with the degree of intensity of their staining. Thus, if they are highly stained, they will appear to adhere closely to, or be fused with, one another more than is in reality the case. Such an appearance may be caused by a surplus of aniline color deposited in the constrictions existing between the individual cells. For this reason it is quite essential for an accurate study of this mutual relationship of these minute cells or granules, that they should be only moderately stained, as represented in fig. 1, *b*, and, moreover, with a suitable transparent staining material; besides, they should not be too much covered by the purulent matter of the expectoration or by the substance of the tubercles. Examined under such favorable circumstances, then, these granules will hardly ever be found completely fused or exhibiting the straight outlines of a so-called "rod;" even those which form diplococci do not appear completely fused with one another, but in all instances still show their original spherical form, separated by a more or less distinct constriction. The individual diploccoci, forming the filament, however, generally appear not fused into one another (fig. 1, *b*.) A close examination of these minute granules will, furthermore, show that they do not all present one and the same diameter; on the contrary, whilst some of them appear slightly larger than the mean diameter, amounting to about 1-1500 mm., others are smaller. The latter very probably represent young cells or granules, formed by the division of larger ones. It is thus that the smallest cells are always observed at one of the ends of the filaments, where, in many instances, instead of a two-celled diploccocus, three cells will be met with. In some filaments, on the other hand, one of the

terminal cells may be seen slightly enlarged and presenting a more oval form. This enlargement and change of form precedes, as I presume, the act of division, and therefore cannot be looked upon as an approach to the bacillus form of a bacterium. In fact, among the many thousands of these filaments which I have closely examined, I have never been able to discover a single one without constrictions, that is, representing the rod-like form of a true bacillus. On the contrary, in every instance, even in those filaments in which the minute cells or granules appear as if fused, I have succeeded in dissolving the minute spherical bodies of which they were originally composed. Examined with my Tolles' homogeneous immersion objective, illuminated with very oblique light, the outlines of these granules are distinctly seen projecting in bas-relief from the filaments.

The facts which I have stated above show, then, that the bacillus tuberculosis, such as it is met with in the human lungs, or other organs, does not present the slightest trace of the bacillus form of a bacterium. A true bacillus, according to Cohn's definition, represents, as I have stated before, a rod without constrictions. Whenever a bacillus divides, the divisions are rectangular, and not preceded by a constriction of the part where the division is to take place. The bacillus subtilis, or hay bacillus, represents a fair type of the bacillus form. This organism is easily obtained from a decoction of hay. In staining a drop of this decoction upon the cover glass with a solution of methyl violet, the bacilli, contained in the former, will readily absorb the aniline color from the liquid, and then show very distinctly the rectangular divisions, which in unstained specimens appear very faintly. It will, furthermore, be found that these marks of division greatly differ from the constrictions which the bacillus tuberculosis represents. Koch

has, as far as I know, never mentioned these constrictions and the head-like character or torula-form of his bacillus tuberculosis. On the contrary, he describes the latter as a minute rod (Stæbchen), and, accordingly, regards it as belonging to that group of bacteria formed by the bacilli. The fact of the bacillus tuberculosis being composed of minute granules was first pointed out by Gibbes, several months after Koch's announcement of his discovery. Taking, therefore, into consideration the disadvantages attending Koch's original mode of staining with his alkaline fluid, of which I have spoken before, I am not disinclined to believe that when he first discovered these filaments he was unaware of their torula-form character; if otherwise, I could not comprehend for what special reason he applied the designation "bacillus" to these torula-form organisms, unless he places this designation upon the presence of spores which he stated to have discovered within the filaments. In mentioning these spores in his first paper on the subject, he expresses himself as follows:* "Under certain circumstances, to be mentioned hereafter, the bacilli form already in the animal body spores, of which the individual bacilli contain several, mostly from 2 to 4; they are oval in form and d stributed at equal distances throughout the length of the bacillus."

As far as I can understand these words, they imply that the bacillus, throughout the length of which the spores are distributed at equal distances, represents a rod, and not a row of minute cells. Or did Koch, when placing the organism which he discovered in the tuberculous tissue among the bacilli, perhaps regard the individual minute cells or granules forming the filaments as individual joints of the bacillus? The spore then should be contained in these spherical joints. Or

* Berliner Klinische Wochenschrift, April 10th, 1882, p. 222.

again, are the minute cells themselves regarded as the spores? If so, then I may repeat the question which I have asked once before: Where is the body of the bacillus? For though it is possible that these minute cells, forming the filament, called "bacillus tuberculosis," may, like other micrococcus forms of bacteria, possess a gelatinous envelope, I have never seen them enclosed in a distinct sheath which might represent the wall of the original bacillus. Besides, these cells or granules are mostly spherical, and not oval, as Koch describes his spores; and, moreover, if they represented the spores, then, as there are not special rods to be seen, it would appear as if the bacillus tuberculosis were constantly sporing. Hence, there remains nothing else to presume but that the oval spores mentioned by Koch should be contained in the minute cells of the filament.

Ever since I have become familiar with the veritable bacillus tuberculosis, of Koch, I have sought in vain in various treatises written on this subject for a clear, definite description of the spores, as well as of the bacillus-rod containing them. To the extent of my knowledge there are only a few authors, who have themselves practically investigated the subject under discussion who have mentioned these spores. On account of certain discrepancies existing in their descriptions, as well as for the wants of clearness of expression, however, I have failed to derive the proper satisfaction from the sources. Thus, for instance, Watson Cheyne, who has investigated the nature of the bacillus tuberculosis on an extensive scale, expresses himself as follows* : "The tubercle bacilli vary considerably in length, the longest being about the $\frac{1}{1000}$ inch. They are

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* Watson Cheyne " Reports to the Association of the Advancement of Medicine by research on the relation of Micro-organisms to Tuberculosis." Reprinted in New York Medical Abstract, May, 1883, p. 175.

narrow (about ⅓ or ⅕ of their length), more or less rounded at
the ends, and they generally present a sort of leaded appear-
ance, clear spots with intermediate stained parts, the rod out-
side the clear spots being also stained (Plate 1, Fig. 10.) The
number of leads in a single rod varies from four to eight,
average six. The rods are generally straight, but not uncom-
monly more or less covered. In tissue they are generally
found singly, sometimes in pairs, united at their ends or stuck
together side by side. At other times there are two or three
lying across each other, the axis of all being more or less in
the same direction. In cultivations they are, as a rule, shorter,
and stuck together in dense masses. Perhaps their shortness
is due to their being broken when spread out on the glass,
but I think they are really shorter when growing slowly.
(Vide examination of Koch's case of injection into the veins).
According to Koch they are motionless." The foregoing
quotation from Cheyne's paper represents all that this author
at the time says of the morphological characters of the
bacillus tuberculosis. While he says nothing of spores, he,
nevertheless, mentions the leaded appearance of the organism,
and, moreover, "clear spots with intermediate stained parts,
the rod outside the clear spots being also stained." In con-
sidering the great extent of Cheyne's investigations into the
nature of the bacillus tuberculosis, his description of the
organism itself is rather meagre. Besides, his expression
regarding the clear spots is somewhat obscure, for while he
speaks of stained parts intermediate to the clear spots, he
finishes the sentence by saying that the rod outside the clear
spots is also stained. As far as I am able to understand the
last part of the sentence, it is a repetition of the preceding, as
otherwise these words might indicate that the stained parts
"intermediate to the clear spots" were not identical with the

" rod outside the clear spots." In the above description there is
nothing said to the effect that these clear spots represented the
spores of the bacillus tuberculosis, though I am inclined to think
that the author may have regard them as such, but not being sure
of their nature, has hesitated to make any positive assertions.
In the same vague manner Formad also speaks of these
spores, so that it almost appears as if these authors had been
trying to avoid to enter into a more definite description of
these bodies.

Two other distinguished authors who also quite extensively
investigated the subject under discussion are Messrs. Rabes
and Cornil. In order to show certain discrepancies found in
the descriptions of the spores of the bacillus tuberculosis, as
rendered by different authors, I shall exhibit the view of these
investigators by quoting some parts of their description of the
morphological characters of the organism in question, as fol-
lows :* "They (the bacilli) consist sometimes of small homo-
geneous rods (batonnets), sometimes of small ovoid or rounded
granules placed side by side. They are difficult to see with-
out a coloring re-agent. Nevertheless, in sputa which con-
tain a great number of them, when treated with a weak solu-
tion of potassa they are recognized as small hyaline and color-
less rods, in which no distinct granules are seen. These small
rods then appear larger than in the preparations where they
have been colored and dehydrated." A little farther on in the
same paragraph the authors continue: "In examining with
the No. 10 homogeneous immersion of Verick and the con-
centrator of Abbé a preparation of phthisical sputum, colored
by Ehrlich's method, a larger or smaller number of small rods
of various length and form are seen, distinctly alike in diame-

* *Rabes* et *Cornil.*—"Note sur les Bacilles de la Tuberculose," and " Journal
de l'Anatomie et de la Physiologie normales et pathologique de l'Homme et
des Animaux." Juillet, Aout, 1883, p. 456.

ter, some of them homogeneous, colored aniline red or slightly
violet, the others formed throughout their whole length by
small colored granules. In the sputa of one of our patients,
the lungs of which were hollowed out by large cavities, a con-
siderable quantity of bacilli was met with, about one hundred
in the field of the microscope with an amplification of 500
diameters. The greater part of these small rods contained
small granules placed side by side. We have left this sputa in
a tube closed by a cork for three weeks. These sputa, under
the influence of putrefaction, had lost their mucus consistence.
The colored preparations have then shown to us that almost
all the bacilli were solely composed of small colored granules;
and they have appeared to us more numerous than in the sputa
examined immediately after expectoration. We have drawn
(see fig. 12, plate XXIV.) these bacteria left to themselves in
the sputa during ten days. It can be seen that the greater
part among them are composed of slightly elongated or spheri-
cal granules, arranged side by side. In examining closely one
of these bacilli with the aid of the homogeneous immersion
objective No. 10, and with a high ocular, the borders of the
small rods, which are rectilinear and parallel, may be distinctly
determined, and it is seen that the colored granules, which
probably are spores, are seated in the interior of the small
rod."*

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*I cannot forbear to remark that it is impossible to form a correct idea of
the morphological characters of the bacillus tuberculosis from those bacilli
represented in figure 12, plate XXIII, to which the authors refer in their
text. For although this figure is marked in their "Explanation" of the
plates as magnified 1000 diameters, the bacilli are represented therein not
larger than those in figure 10 on the same plate, marked as magnified only
150 diameters. The granules of the true bacillus tuberculosis when magni-
fied 1000 diameters, present a diameter at least three times as large as rep-
resented in the above mentioned figure. The latter, therefore, has missed
its purpose of illustrating the morphological characters of the bacillus
tuberculosis.

Two years afterwards, in a lecture delivered by Cornil on Pulmonary Tuberculosis,* this investigator makes the following remarks: " The typical bacilli of tuberculosis, as observed in sputum and lung sections colored by Ehrlich's method, appear entirely homogeneous, or formed of small beads adhearing end to end."

" These small beads are considered the spores of bacilli more through analogy with other bacteria than by a true demonstration. We do not know, however, whether this parasite found in tubercular products be not the offspring of parents having an entirely different morphological appearance," etc.

These words are clear enough to show that at present this author also entertains some doubts as to the existence of the so-called spores of the bacillus tuberculosis, he admits even that they never had been truly demonstrated.

The best information concerning the spores of the bacillus tuberculosis which I have thus far obtained, was from a review written by Litten on the "Ætiology of Tuberculosis," by Koch, published in the " Mittheilungen aus dem Kaiserl. Gesundheitsamt." In order to render my arguments on this subject clearer to the reader, I shall quote from this condensed account on the ætiology of tuberculosis the part which treats of these spores, found on page 262 of the "Deutsche Medizinalzeitung," March 24th, 1884. It reads as follows: "A further *very important property of the tubercle bacilli is the formation of spores.*" It was Koch who first observed the appearance of shining bodies in hay-

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New Orleans Medical and Surgical Journal.—A lecture by Dr Cornil, Prof. of Pathological Anatomy, etc., Paris. Reported by Dr. E. Laplace, of New Orleans, Sept. 1885.

bacilli, which remain after the disintegration of the bacilli and are capable of germinating anew into bacilli. For the latter reason Cohn regarded them as the fruit-form of the bacilli, and designated them spores. Tinged with aniline colors these bacilli appear in the microscopic picture with short articulations, mostly consisting of two articles of which the single ones are darkly colored throughout, still resembling bacilli free from spores. In many articles, however, the appearance of a light spot is observed, which gradually increases in size while the colored contents of the article are more and more retracted to both ends, and while the sides are only still bounded by fine lines representing the outlines of the article. The light space in the interior of the bacillus article is *the spore*, which is not distinguished by its lustre but by its remaining free from coloring matters. The articulation, of course, does not always appear so sharply defined in opposition to one another as in the bacilli pictured by Koch upon the photograms (No. 76 of volume I). In many varieties of bacilli, as, for instance, in those of splenic fever, the articles appear closely opposed to one another and form a continuous thread which contains the uncolored spores at equal distances. The formation of spores in the tubercle bacilli takes place in the same way. The mutual connections of the latter remain preserved and they do not break up into single articles, but in each article a light body is formed so that the bacillus, after being stained, resembles a dark minute thread, interrupted by light egg-shaped places. With the use of the strongest systems and a considerable amplification, it may be ascertained that the spore containing bacillus presents, only on a smaller scale, the same picture as the spore-containing bacillus of splenic

fever. The spores are egg-shaped and bordered on their margins by a fine colored line, while their number amounts from 2 to 6 in a single bacillus. As every single spore occupies an article the number of the articles of the bacillus, that is the simple elements of which the latter is constructed, may be inferred from the number of spores. When a substance with spore-containing tubercle-bacilli is examined in a feebly refractive liquid medium the bacilli appear then provided with highly lustrous bodies; accordingly the latter cannot be vacuoles or simple empty spaces contained in the protoplasm of the bacillus, but must represent genuine spores. Upon the accompanying figures of the spore-containing tubercle-bacilli the latter, in order to represent the spores, had to be drawn larger than they in reality appeared by the respective amplification used."

If I understand the meaning of the preceding quotation correctly, Koch describes his bacillus tuberculosis as presenting the form of a true rod, in which, as the writer of the review expresses himself, "the mutual connection of the articles of which the bacillus is composed remains preserved." The rods do not "break up into single articles, but in each article a clear body is formed, so that the bacillus, when stained, resembles a minute dark thread, interrupted by light egg-shaped spaces." He futhermore states that the bacillus tuberculosis, when containing spores, presents the same picture, only on a smaller scale than the spore-containing bacillus anthracis. Now, as far as I know, and as all drawings of the latter—Koch's own "Untersuchungen ueber die Ætiologie der Wundinfections Krankheiten" (fig. 4, 13 and 14) included—show, the articles of this bacillus are characterized by square ends and do not repre-

sent spherical bodies. In the same manner has Koch represented in the form of a rod the bacilli he discovered in the blood of septicæmic mice as well as those he met with in the erysipelatous ear of a rabbit (l. c. figs. 1, 2, 3 and 12). This difference of form shows plainly that the bacillus tuberculosis *does not* present on a smaller scale the same picture as the bacillus anthracis.

During the whole course of my investigations into the nature of the bacillus tuberculosis I have closely examined the beaded filaments representing it, with the view of discovering the oval spores in the individual cells of the latter, —presuming, of course, that these cells represented the individual cells of the bacillus,—but my efforts made in this direction have been in vain. My examinations, as I have already stated before, were made under the most favorable circumstances,—that is, with Tolles' 1–10 homogeneous immersion objective, Abbé's illuminator, and the finest daylight that can be obtained from a clear southern sky. To these advantages, however, some one might perhaps raise the objection of my objective not being sufficiently high in magnifying power for discovering the clear oval spaces representing the spores in these minute cells. My reply to such an objection would be that the correction of this objective is so perfect as to render it capable of bearing not only the eyepiece B, but even C, without any more loss of definition than that caused by the loss of penetration attending all high eye-piecing. The amplification, however, obtained with my eye-piece B, as may be judged from my figures of the bacillus tuberculosis accompanying this paper, is more than sufficient to show any clear unstained oval spot or space in the cells of the stained filaments, if really contained

therein. A still higher amplification, without much loss of definition, I might obtain by making use of my Tolles' amplifier. But no advantage is gained in making these examinations with very high powers, for the reason that too much penetrative power is lost by the shortness of the focus of the latter to clearly distinguish the unstained spores in the interior of the minute cells of the bacillus.

Not having been able, then, to discover anything in the form of a spore in the granular filaments of the bacilli tuberculosis, met with in the tuberculous organs and sputa of man, and not feeling inclined to disregard the statements of Koch, I can only presume that the spores which this investigator describes he must have observed in those filaments of bacilli tuberculosis which he obtained by his artificial cultivations in nutritive substances, differing in their nature, of course, from the tubercular substances of the human body. That higher forms of bacteria are really obtained in this manner, has been proved by the researches of Buchner, Zopf and others.

Before closing my remarks on the morphological characters of the bacillus tuberculosis, I cannot forbear to point to the want of correspondence existing in the description of the spores of this bacillus given by different authors. In the passage which I have quoted above from the writings from Koch and Rabes and Cornil on the subject, the reader may, perhaps, already have noticed that this want of correspondence is very great; for while the former regards the granules or minute cells as individual articles of his bacillus tuberculosis in which the spores are contained in the form of *clear, unstained oval bodies,* the latter look upon the *stained cells themselves* as representing the spores, enclosed by the protoplasm of the

bacillus. In the first case *the spores do not absorb the staining material*, but remain uncolored and clear in the stained wall of the bacillus—article, in the other the minute cells—which Koch regards as composing the whole body of the bacillus,— are regarded to represent only the spores, and *to be capable of absorbing the staining material*, while the body of the rod—as far as I am able to interpret the meaning of the words of the authors—*remains unstained*.

Watson Cheyne, as may be gathered from the passage concerning the morphology of the bacillus tuberculosis, and which I have above quoted from his writings, speaks, like Koch, of *clear spots* with intermediate stained parts, but, as I have already pointed out before, obscures the meaning of his words by adding that the rod outside of the clear spots is also stained. In examining the illustrations accompanying his paper, however, it will be found that the filaments of the bacillus tuberculosis represented as magnified 2350 diameters in figure 15, do neither show "clear spots" nor "stained rods" outside of these spots.*

Although I have seen in a number of papers these spots of the bacillus tuberculosis mentioned as "clear spots" enclosed in a stained rod, I have never seen them distinctly represented among the illustrative figures accompanying some of these papers but in one instance; I refer to figures illustrating a reprint; also in the *New York Medical Record*, of a paper on "Gram's Method of Staining applied to Pneumonic and Tuberculous Sputum," by M. Afanassiew. Fig. 5 of this paper represents some tuberculous sputum stained by Gram's method

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*In referring to the illustrations of Watson Cheyne's paper, I of course take for granted that those accompanying the reprint of his paper in the "New York Medical Abstract," and which I have before me, are correct copies of the original.

and containing numerous bacilli tuberculosis, among which several rods are observed which contain a number of clear, unstained spots or spaces in their interior.   As these rods, however, are quite conspicuous among the other ordinary bacilli filaments by being of a greater thickness than these, it appears to me strange that I should never have observed them among the thousands of bacilli tuberculosis contained in the very numerous preparations of stained sputa which I have hitherto examined.   But having no reason to suppose that Afanassiew drew these spore-containing rods in his paper without having actually seen them, I am almost inclined to regard them as belonging to another species of bacillus and their presence in this specimen of sputum as accidental.

Besides the discrepancies met with in different descriptions of the spores of the bacillus tuberculosis—some of which I have quoted above—there are other reasons for doubting the real existence of these spores.   Thus, we might point to the comparative rarity of the presence of single granules among the hundreds of bacilli tuberculosis filaments contained in a minute portion of tuberculosis sputum or in a thin section of tuberculous lung.   For if these spores did really exist in the so-called rod of the bacillus tuberculosis—it matters not whether in the form of Koch's clear, egg-shaped, *unstained* spaces or in the form of Rabes' and Cornil's *stained* granules—they would, in either case, eventually be liberated from the rod and appear among the other bacillus filaments in the form of cocci, and as, according to the views of the above named authors, each bacillus filament, or rod, either contains or represents these spores, they should be present in great numbers in each preparation of tuberculous sputum or lung. This, however, is not the case, for although some cocci forms may be observed in most preparations, they are too few in num-

ber to account for a general sporing of all the filaments contained therein.

In closing my remarks on the morphology of the bacillus tuberculosis I may, therefore, repeat that in the tissue of man, at least, I have never met with this organism in the form of a spore-containing rod, but always in the form of a filament conposed of minute granules, or cells, and multiplying as it appears by a division of the latter. But as this filament represents morphologically a so called *sphero-bacterium,* I shall follow Zopf in calling it henceforth the " *bacterium tuberculosis.*"

(*To be continued.*)

AN INAUGURAL THESIS.*—SOME MODIFICATIONS TO THE ORDINARY METHODS OF TREATING TRANSVERSE FRACTURES OF THE PATELLA. *By* GEORGE A. STAPLES, A. M., M. D., *of Dubuque, Iowa.*

A communication made by M. Richelot[†] in 1883 to the Société de Chirurgie, of Paris, relative to the comparatively frequent casualties arising from treating transverse fractures of the patella by opening the knee joint and suturing the fragments, has awakened, especially among French surgeons, a reaction against this method of treatment, although it is advocated by the great surgeon Lister. In our own country Dr. J. A. Wyeth,[‡] who has collated nineteen cases thus treated, with three deaths, has also protested against the operation; but it is probably true that the majority of Modern operators coincide with the views of Lister,[§] as expressed in his paper

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* For the degree of Doctor in Medicine.

†Contribution a l'etude des suites des fractures, de la rotule, etc. These de Paris, '84. Par H. Labouin.

‡Med. Record, 1882, No. 22, p. 596; and ibid., 1885, Nov. 21, page 581.

§London Lancet, Nov. 3, 1883.

before the London Medical Society, and regard the measures therein set forth as a great advance in surgery. Stimulated by the fact that three cases of transverse fracture of the patella have recently come under my observation, and noticing the conflicting views as regards treatment of that fracture, I was led to study somewhat the literature of the subject, and I present below the results of that study.

The causes of separation of the fragments in the fractures in question are, first, the action of the quadriceps extensor muscle, and, second, the effusion into the joint.

Gulliver* has shown that, when the tendinous expansion of the quadriceps covering the patella is torn, the fragments can be separated 4 2-10 lines. If the diastasis is greater, the fibrous capsule must be split on both sides. Malgaigne,* by experiments on cadavera, obtained like results, and Girdner† found that if he cut only the covering of the patella, a diastasis of no more than ½ to ¾ of an inch could be attained, but if he cut freely into the capsule the fragments could be pulled apart three inches.

If, now, a fracture occurs, and the fibrous covering and capsule of the patella be torn on both sides to a greater or less extent, the upper fragment is drawn up by a contraction of the quadriceps; it will also be drawn somewhat outward by the contraction of the vastus externus,‡ this muscle being relatively very strong. Retraction of the ligamentum patellæ will also pull the lower fragment somewhat downward.

As stated above, the second cause of the diastasis is intra-articular effusion. This fact was noted by Malgaigne§ and the

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*A. Hentzolt. Ueber die Behandlung, der subcutanen Querfracturen der Patella, etc., p. 8.

†Hamilton. Fracture of the Patella, p. 90.

‡Harrison Allen. Human Anatomy, Section III., p. 308.

§Hentzolt, loc. cit.

English surgeons of the last century, and various means were adopted to get rid of the effusion. Flajani* in 1786 employed revulsives for that purpose. Thos. Castle† applied an evaporating lotion of white wash and used leeches till the tension subsided. Of late years cold and compression (Ravoth) and vesication (M. M. Guyon and Gosselin) have been strongly advocated.

The latest investigations of Riedel, and the clinical observations of Volkmann, Kocher and Langenbuch, show that absorption of this effusion does not take place quickly, and that retention of blood clots in the joint creates a chronic hydrarthrosis, that, in its turn, helps to keep the fragments asunder.

Riedel,‡ by experiments on dogs, found that complete absorption generally took place within two months. But in dogs the clotting of the effused blood does not seem to hinder the absorption materially, while the reverse is true in man. Langenbuch§ did not succeed, moreover, in aspirating the hemarthrosis twenty-four hours after the injury, because the blood had already clotted. Lücke had the same experience. Secher and Volkmann,‖ three days after the accident, found the blood already coagulated. If cases have been recorded where the effusion remained fluid from six to eight days, it should not be inferred that it will stay in this fluid state, for a part will certainly clot, and the clots may persist for a long time. Volkmann¶ observed fourteen weeks after an

*Du Traitement des Fractures Transversales de la rotule, etc. These de Paris, 1884. Par C. Divernesse.

†Castle. Manual of Surgery, Lord, 1834. p. 394.

‡Deutsche Zeitschrift Chir. Bd. XII.

§Langenbuch. Zehr. Congr. der Deutscher Gesellschaft fur Chirurgie.

‖Volkmann. Centralblatt fur Chir. 1880. Nr. 10.

¶Hentzolt, loc. cit.

injury a large mass of clots remaining in the joint, and the
same thing was seen by Hentzolt* at the expiration of a half
year. Jarjavay, in 1861, first evacuated the effusion in the
knee-joint. He was followed by Voillemier and Broca.* In
1872 M. Dubrueil* thus operated on a case and the opera-
tion was followed by death. This fact being reported to the
Société de Chirurgie of Paris, that body condemned this
therapeutic measure for the relief of the effusion.

In Germany, Volkmann† first made the articular puncture,
removing the fluid two days later with a syringe. The frag-
ments were thus drawn together by plaster strips and held by
a plaster of Paris bandage. In eight weeks he thus obtained
a strong bony or fibrous union.

Schede,‡ besides immediately aspirating the joint, syringed
out the cavity with a three per cent. carbolic acid solution.
The wound was then covered with protective silk, on which
he placed salicylated cotton. Five cases were thus treated by
him with an excellent result in each. Jourowski, in 1878,
reported several cases in which good results were obtained by
removal of the effusion. Marcy and Cok recommend the
operation, but not the antiseptic injection ; Kocher§ is of the
same opinion for the reason that phenic intoxication might
occur.

M. Poinsot‖ after gleaning from literature the accounts of
nine cases in which the fluid was evacuated under antiseptic
precautions (the fatal case reported by M. Dubrueil occurring

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*Archives Generales de Medicine. Mars., 1884. Ad. Jalaguier, Revue
Critique.
†Hentzolt, loc. cit.
‡Shede. Centralblatt fur Chirurgie. 1877. p. 657.
§Kocher. Centralblatt fur Chirurgie. 1880.
‖Poinsot. Revue de Chirurgie, 10 Janvier, 1882, p. 52.

anterior to the use of antiseptics) concludes that the pro-
cedure is comparatively harmless, and that, because of the
ease with which it allows the fragments to be approximated,
it should be employed as soon as possible after the injury.
M. Jalaguier, in a very interesting article, remarks that since
the work of M. Poinsot has been published, aspiration has
steadily gained ground among French surgeons ; and re-
cently the Société de Chirurgie of Paris has publicly re-
versed its judgment of 1872.   The change of opinion is
well expressed by M. Trélat* in the following words : "To-
day I puncture joints that are full of blood, and, neverthe-
less, in the discussion of 1872 I publicly combatted the
practice, declaring that I would prefer a large opening of
the joint.   My change of opinion is the result of the intro-
duction of the antiseptic method into surgical practice."   In
England, where arthrotomy with bony suture has aroused
such important discussions, it seems that the question of
puncture to evacuate the effusion has been left a little in the
shade.   The operation, though, in that country has its
earnest partisans, particularly Mr. C. Heath† and Mr.
Hutchinson, who regard the effusion as the chief cause of
the diastasis.

Its strongest advocates are the German surgeons.   Hentzolt
says : " Experience to date speaks in every case in its favor,
since this procedure, carried out with the strictest antiseptic
precautions, is completely harmless."   Volkmann, Schede,‡
Secher, Rinne,§ and Lüke express similar opinions. Marcy‖
also supports the operation, basing his advocacy on a large

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*Jalaguier, loc. cit.
†N. T. Med. Record, May 31, 1884.
‡Schede.   Centralblatt fur Ch. 1877.   No. 42.
§Rinne.   Centralblatt fur Ch. 1877.   Nos. 49 and 50.
‖March.   Centralblatt fur Ch. 1880.   No. 27

experience ; he operated 124 times upon 75 different knee joints; affected from the most varied causes, with but one bad result.

It seems fairly proven that puncture of the joint, properly carried out, is an innocent operation ; since, therefore, it is assuredly undeniable that the persistence of a large quantity of blood in the synoval sac must exercise a harmful influence on the synoval membrane, and since, by the state of distension in which it places the joint, it cannot but hinder the approximation of the fragments, it appears the part of wisdom to evacuate the intra-articular effusion as soon as the patient is seen.

In the treatment of transverse fractures of the patella the custom has long been to flex the thigh upon the body and to extend the knee, thereby securing relaxation of the triceps. Valentin* first recognized this principle and proposed elevation of the extremity. Astley Cooper† proposed that the patient take a half-sitting posture with the foot elevated and leg extended. Langenbeck and others keep the patient in bed and let the extended limb lie flat on a pillow. Coster‡ placed the limb on a plane inclined from the foot to the trunk, so that the limb thus raised formed with the axis of the body an angle of about 45°. R. Liston§ recommends extension by a straight splint extending from a little below the tuberosity of the ischium below the middle of the leg. The method of Valentin, with slight flexion at the hip, is generally preferred, as it is more suitable for long use. An appropriate position in many cases is competent to effect firm union. It can certainly be competent if the lateral parts of the capsula are not

*Hentzolt, loc. cit. p. 14.
†A. Cooper. Treatise on Dislocations and Fractures. p. 207.
‡Coster. Manual of Sur. Operations. Phil., 1825.
§R. Liston. Elements of Surgery. Phil., 1837.

much torn, and there is little separation.   It is better first to empty the effusion by aspiration. Prof. v. Wahl,* of Dorpat, in '83 treated in this way an old woman, 60 years of age, where the separation of the fragments was not great. The joint was twice punctured under the spray; the wound was irrigated with a bi-chloride of mercury solution, and dressed with iodoform dressings. Simple elevation of the limb was practiced. The result was perfect.

Warren,† of Boston, earnestly champions treatment by position, in the following words : " Transverse fracture of the patella, attended, as it often is, by great separation of the fragments, may be most successfully treated by position alone."   He also believes that the limb does better lying flat in bed than when elevated.

In this connection the writer begs leave to report the following case. A boy, aged nineteen, while tending a saw in a sawmill, was thrown violently, by the giving way of the machinery, against a heavy stick of timber. The accident occurred Aug. 11, 1883.   Two days later he was brought to Dubuque, when Dr. Jas. M. Boothby, was summoned. The writer, in company with the doctor, saw the patient.   A fracture of the left patella, transversely, the fragments being separated somewhat over an inch, was discovered.   A temporary dressing had been applied by a surgeon at the place where the patient had been injured.

The patient was at once placed in bed, his leg resting on an inclined plane. Little dressing, because of the tenderness of the joint, could be applied. The boy was discharged, well, on Oct. 10th, there then being but a slight fissue perceptible be-

*Hentzolt, loc. cit. p. 15.
†Warren. Surgical Observations. Boston. 1867. p. 322.

tween the fragments.   He, when last seen, on Feb. 1, 1885, has perfect use of the limb.

Coaptation of the fragments may, broadly speaking, be obtained by the direct or indirect method.   To the former plan belong the various kinds of sutures, and usually as a prelude to arthrotomy; to the latter plan belong the different means employed without penetrating the skin and the many apparatuses applied after a preliminary rupture of the integument.   I purpose only to consider those forms of indirect coaptation that leave the skin intact.

Malgaigne divided the dressings known at his time into four groups: (*a*) those exercising circular pressure, and more or less surrounding the patella; (*b*) those exercising parallel pressure, operating upon each fragment, while working transversely upon the axis of the limb; (*c*) those exerting concentric pressure, pressing from above downwards and from below upwards upon the circumference of each fragment, and (*d*) those that press only upon the upper fragment.   Malgaigne expresses his opinion of them all in these words: "If there is an incontrovertable fact in surgery, it is the incompetency of these (the dressings) in the attainment of a regular and firm union."   He explains this by the fact that the patella has no prominences sufficient to furnish points of support to the dressings, and that it is difficult to press down the quadriceps and ligamentum patellæ enough to make two furrows in which the straps can rest.   Even if the dressing has been applied firmly the fragments dip posteriorly and the fractured surfaces bulge forward from each other.   The idea that the swelling of the joint militates against true approximation, and that the surgeon in some way

should allay this, does not seem to have occurred to Malgaigne.

It is interesting to note that simple extension by means of gutter splints is recommended by Paul of Egina.*

These fractures were treated by circular pressure by Albucassis* toward the end of the fourth century. He applied a splint with a fenestrum for the patella. This was firmly held by a bandage. The splint was afterwards replaced by a ring of leather, and the leather in its turn by twisted wire. Parallel pressure was first made by Muschenbrok,† a mechanic of Leyden. His apparatus, as modified by Arnaud, consisted of a posterior hollow splint of tin, the sides of which were pierced with holes, and of two broad concave crescents that were placed, the one above, the other below the patella. The crescents were fastened to the posterior splint with screws.

Concentric pressure was first used by Lavanguyon about 1680. The apparatuses were modified by Ravaton and Petit.*

Pressure acting solely on the upper fragment was first employed by Petit about 1770.†

The method of Astley Cooper‡ was to well bandage the extremity, and just above and below the patella to take several circular turns; strong bands were fastened laterally to these turns and their free ends tied in such a manner that the fragments could be drawn together. Later, Cooper substituted leather rings for the bandage and straps, with buckles for the lateral bands. Unfortunately, a bulging for-

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* Divermesse, loc. cit.

† Hentzolt, loc. cit.

‡ Cooper, loc. cit.

ward of the fractured surfaces could not be prevented by this dressing. Boyer attempted, therefore, to remedy this defect by direct pressure over the fracture, and constructed an apparatus of which Malgaigne said: "It unites great strength with great simplicity." Boyer placed the limb in a well padded wooden splint bearing nails opposite the joint; to these nails he attached straps extending over and under the patella; over the knee-cap he then laid a compress moistened with a resolving fluid, and confined it by a roller.

Sansom* applies long strips of plaster reaching from the middle of the thigh over the fracture to the middle of the leg, and just over the fracture he makes a loop of 8–10 inches. Rollers are then placed as braces to the plaster and the loop twisted by a stick.

Castle† recommends, after extension, that a well padded splint be applied with the patient in the sitting posture; that a leather strap be buckled around the thigh, above the fracture, and from this that another strap be passed beneath the foot, the latter being raised. The strap is then brought up on the other side of the knee and buckled to the circular strap above the joint.

Woodman‡ employes two gutta percha splints, that, while yet warm, are fitted anteriorly and posteriorly. After they have hardened he cuts a fenestrum for the patella in the anterior splint. Rollers are then passed around both.

The dressings of Burge,§ Lonsdale,‖ Lansdale,‖ Beach,‖ Pelikan‖ and Wechler‖ are similar in principle to the appa-

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* Hentzolt, loc. cit.
† Castle, loc. cit.
‡ Woodman, Medical Times and Gazette, Aug. 20, 1870.
§ N. Y. Med. Record, Apr. 15, 1868.
‖ Hentzolt, loc. cit., p. 21.

ratus of Muschenbook, and exclude bandages. Burge applies well fitting sole leather splints, to which are attached extension weights. Pelikan uses pads above and below the patella, and a third of circular shape to press down the fragments from above.

It is unnecessary to go through the whole list of known dressings, some of them seeming to be of little value. It is of slight importance of what material the dressing consists, or whether, instead of the two concave plates of the Arnaud apparatus, smaller concentric or horse-shoe-shaped plates are chosen, and whether these are padded or not.

Immovable dressings, such as the starched bandage of Sentin, the dextrine bandage of Velpeau, or that of liquid silex were, earlier in the century, approved by many. Of late years plaster of Paris is much used, but it can only bring about a good result if the intra-articular effusion is removed (Heath). If this is not done the dressing must be often changed,—an unpleasant operation.

Much ingenuity has been exercised by American surgeons in the treatment of this fracture; the dressings of Agnew,* Hamilton and others are well known and popular. The plan of Prof. Hamilton,† approved by Prof. Gross,‡ as it was employed in the two cases described below, that came under my own observation, deserves especial notice.

It consists of a single inclined plane, long enough to support the thigh and leg, and about six inches wider than the limb at the knee. The plane is well padded and the member laid thereon, care being taken that the space under

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* Agnew, Surgery, vol. I., p. 974.

† Hamilton, Fractures and Dislocations, p. 447.

‡ Gross, System of Surgery, vol. II, p. 211.

the knee is well filled. Then a sort of testudo genu with a figure of eight plaster bandage and roller is placed over the patella, first approximating the fragments as well as possible.

Finally the whole limb is fastened to the splint by a second roller, reaching from the ankle to the groin. In the cases to be described, the only modification made was that the posterior splint was somewhat guttered and a light anterior one was added.

On July 13th, 1881, P. K., a brakeman, while getting on a train moving at the rate of ten miles an hour, struck his right patella on a bolt while the leg was somewhat flexed. He said that there was a loud snap and he felt as if shot. As he recovered himself he could feel that the knee-cap was injured, as, to use his language, "the upper piece stood out straight." Being a vigorous man, about twenty years old, he walked a short distance, dragging the injured member along. A temporary dressing was applied by a surgeon at Lansing, Iowa. The next day the patient was brought to Dubuque, where he was seen by Dr. G. M. Staples and the writer. The Hamilton dressing modified, as spoken of above, was put on, the fragments being separated one and a half inches. He was kept in bed and the wound regularly dressed. On Nov. 1st, patient went to work again, there being but a slight furrow noticeable. Flexion and extension were not good, and if the patient slipped slightly he noticed that the joint became painful and swollen.

On June 13th, 1883, while the patient was getting off a slowly moving car he stepped on a piece of wood and turned his right foot. He felt the patella snap and was at once disabled. When the writer saw him there was considerable swelling of the joint and the fragments were separated at least

two inches. The same treatment was given him as before, and without any noteworthy trouble he could get about on Oct. 1st. His leg, though, was very weak, for he could not walk a long distance. For a short walk the leg was strong enough. There was a diastasis of about half an inch. In December of 1883, while descending some steps, the patient slipped and fractured the patella a third time, the separation being about one and a half inches. He did not call a surgeon, but dressed it himself and kept quiet but a short time. As the leg became useless he came under the charge of Dr. G. M. Staples, who kept the patient in bed for a month with the Hamilton dressing, and then freshened the edges of the patella fragments with a drill pressed through the integument. This was done on May 7th, 1884. The patient got about for the first time on July 28th, with the leg stronger than it has been since the first injury.

Whenever the patient slips, the leg is apt to be strained, and swell and be tender for a few days. He can now flex the leg to about a right angle with the thigh, and extend it fairly well. The knee cannot endure the cold, and he protects it with a silk cap and chamois skin. The diastasis has increased, being 2¾ inches when the limb is extended, and 4 inches when it it flexed. But the member seems to increase in usefulness every day. There is some muscular atrophy. Two inches below the patella the circumference of the right leg is 14 inches, of the left 14⅛ inches; four inches above the patella the circumference of the right leg is 15 inches, that of the left leg 15¾ inches.

I cannot find in literature any cases exactly similar to the above. At the Société Medicale de Reims, Séance du 16 Janvier, 1884, M. Langlet* showed a patient who had twice

*Union Medicale et Scientifique du Nord-Est., 15 Mai, 1884.

fractured his patella, the second time evidently by muscular action. The two fragments were separated the breadth of four fingers, but the patient could use the limb well if the knee was first bandaged.

A man, F. H., forty years of age, while passing over a frozen surface, slipped and fell, striking his right knee. He was brought disabled to the office of Dr. G. M. Staples, where he was seen by the writer. There was a transverse fracture of the patella, the fragments being separated about an inch. The accident occurred on Dec. 31, 1884. The leg was dressed as in the former case, and the patient sent home; he was then placed on his back in bed and the limb elevated. On Jan. 3, 1885, the wound was dressed, and atrophy of the quadriceps determined. Four inches above the patella the right leg measured 15¾ inches in circumference, the left at the same point 16 inches; while two inches below the patella the girth of the right leg was 12½ inches, that of the left 13 inches. The patient has to-day, March 31st, 1886, regained power in the leg every week, there being slight atrophy of the quadriceps, and apparently a strong fibrous union.

In his recent work on surgery Prof. Agnew * gives three indications for treatment of transverse fracture of the patella : first, to place the limb in that position which will secure the most complete relaxation of the quadriceps; second, to bring together and so retain the parts of the fractured bone, and third, to prevent anchylosis. In the concluding portion of this paper I purpose to discuss another indication, seemingly of first importance, but which, so far as I know, has not been noticed by English or American surgeons. That indication is to so treat the quadriceps as to avoid atrophy and degeneration of its structure.

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* Agnew, loc. cit.

There is a certain amount of impotence that regularly follows these fractures; in some cases this seems due to a stiffness of the joint, in other cases to a certain flabbiness of the member. The latter condition is most frequent, and therefore, most important. It will be found that the patient cannot walk well, but is easily fatigued. Whether this state is due to the nature of the callus, to the length of the callus, or to muscular atrophy, is a most interesting and important question. Mobility of the fragments, want of nutritive elements in the lower fragment, the presence of synovial fluid mixing with the exudate of the callus, and poor coaptation have each been urged as a reason for non-bony union. Each probably has some influence, and, as the experience of Lister has shown, defective coaptation plays a considerable part. But as the following case proves, the chances of a bony union are as good with a simple dressing as with section or the hooks of Malgaigne.

In June, 1883, a patient entered the service of M. Lancereaux,* at la Pitié, for pulmonary tuberculosis; while there he fell upon the floor and fractured his patella. M. Gilsen, interne, applied a posterior splint and bandaged the extremity. On the fifteenth day the dressing was taken off and the patient left in bed. Five months later he died of phthisis.

At the autopsy the patella was found with its volume and dimensions normal. Two transverse fissures marked the spots where two fractures had occurred. There was a bony callus so firm that the point of a bistoury broke against it. M.Verneuil presented the specimen to the Société de Chirurgie. But a fibrous callus, if short and thick, is as good as a bony one; certain surgeons, according to Berger,† even prefer it, dreading the anchylosis that may come with a bony union.

* Labonne, loc. cit.

† Berger.   Dict. Encycloped. des Sciences Med., T. V., p. 295.

Therefore, non-bony union cannot explain the impotence of the member, and the question is natural, why two patients with union of the fragments apparently similar, as has been noted, get about, nevertheless, in a very different way.

Valtât* some time ago remarked that muscular atrophy is provoked by arthritis; but in connection with fractures of the patella it has been but recently noted. In 1880 and 1881 M. Verneuil gave several clinical lectures on the subject at la Pitié. Before his time the impotence of the leg had been ascribed to the separation of the fragments.

Nélaton, in 1844, stated that the impotence was proportionate to the length of the fibrous ligament between the fragments. Malgaigne, in 1848, published a similar view.

Follin, in 1868, attributed the difficulty of locomotion to weakness of the extensors, the fibrous callus not offering the same leverage that a bony one would.

M. Gosselin† speaks several times of the loss in volume of the thigh muscles after fracture of the patella, as, he says, occurs in most muscles after fractures. But agreeing with Nélaton and Malgaigne, he ascribes the impotence to fibrous union or a long callus.

M. P. Berger‡ repeats the same doctrines. He says that the weakness of the leg is the result of persistent separation of the fragments over 1 ctm.; that the loss of power indicates the loss or partial abolition of the function of the quadriceps, but it is because the muscle cannot act efficiently upon the fragment of the patella.

On the other hand, M. Verneuil thinks that the chief factor in loss of power of the limb is atrophy of the quad-

* Labonne, loc. cit.
† Clinique Chir.—Gosselin.
‡Berger, loc. cit.

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riceps, particularly of the middle portion, the rectus femoris. Whether arthritis is present or not, atrophy comes on, usually very soon; two days after the injury it may be determined by measurement, comparing the one with the other limb. Flaccidity and softness of the tissues on palpation also are quickly found.

It has been stated above that atrophy usually occurs after arthritis. Fracture of the patella is almost always followed by a more or less marked arthritis. But there are cases where that complication is wanting, or at least not evident, as in fractures from muscular action, and yet the atrophy of the thigh and leg muscles comes on as in cases of manifest arthritis.

M. Richolet* thus expresses himself.

"In weakening the member and abolishing its functions another factor, atrophy of the triceps (quadriceps), comes in. The muscle has indeed been seen to atrophy, and it has been said that because of defective union its degeneration impedes locomotion; but the true rôle of that degeneration has been misunderstood, for the reason that fractures of the patella, and their consequences, were studied long before the influence of diseases of the joints upon the neighboring muscles was known. To-day we know that an arthritis of the knee, slight or severe, is accompanied almost inevitably by atrophy of the quadriceps, showing itself in the first few days. The arthritis appears to be the result of a reflex pathological action. The lesion may be ephemeral, or last some time, and get well spontaneously by exercise of the leg. Sometimes, however, it is rebellious and persistent, and that without any relation between the gravity of the inflammation and that of the atrophy being established. But a fracture of the patella cannot happen without articular

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* Richelot, Union Medicale, etc., 2nd Sept., 1882.

inflammation of variable intensity, and this cannot escape the laws that govern arthritis evoked by other causes.

"If I am not deceived, the lesion of which I speak is better fitted, with its varieties, than any other to explain the functional states so diversified that are left after fractures of the knee-pan. The patient gets about well when the atrophy is very little and disappears promptly. When it is more severe, and gets well of itself in a few months, the functions of a member, believed to be forever compromised by a vicious union, are re-established little by little against every hope, and in spite of the persistence of a pronounced separation."

In support of the above statements M. Richelot showed two patients. Placing his hand upon the hip of the first of these he asked him to extend his leg; the patient could not do so, no contraction even with his greatest effort took place, and none was transmitted to the upper fragment, which would have happened if the diastasis had been the peccant cause. M. Richelot, moreover, demonstrated that the circumference of the sound thigh was 5 centimeters larger than that of the injured one, while there was but a slight diastasis of the fragments.

In the second patient exhibited, the fragments were separated a good inch; the interposed callus was apparently of slight thickness and strength, for a deep fossa existed. It seemed as though the action of the rectus would scarcely be transmitted to the patellar ligament, and yet extension was easily made. The patient could readily raise his heel from the bed, and the wounded member was scarcely less vigorous than the sound one. When the hand was placed on the quadriceps, energetic contraction was felt when he was bidden to extend the leg, and the most careful measure-

ment could not find a difference of 1 ctm. in the circumference of the two thighs.   Muscular atrophy, therefore, hardly existed.

M. Richelot therefore concludes that ingenuity employed to get the fragments in perfect coaptation is misspent, and that most of the manifold contrivances for that purpose should be laid to rest in the arsenal of surgery.   To obviate the separation the most simple means are the best, and when after treatment of 30 to 40 days there is found a fibrous callus and movable fragments it is useless to prolong further repose and to condemn the patient to new attempts at coaptation.   Attention must be given to the quadriceps, for when it regains its power the patient is cured.

The pathogeny of this atrophy is doubtful.   Its cause is probably the arthritis, though M. Picqué* has collated cases of atrophy where marked arthritis did not exist.   Whatever the cause, its seat is in the quadriceps, the rectus being first involved, and the rest of the muscle being gradually invaded.   Faradic contractility is rapidly lost, either partially or entirely.

There is visible withering even to the eye, as observed in many cases by M. Petit.   M. Labonne believes that this atrophy is the cause of the functional impotence that usually follows fractures of the patella, for the following reason: If union by fibrous callus leaves the leg impotent, and if at the same time muscular atrophy exists, it is difficult to tell the part that each plays.   But if one of these two factors can be eliminated, and if the impotence disappears or persists, the true cause can be determined by induction.   I cite a case in point.

*Picque.   Reflexions Cliniques sur les fractures anciennes de la rotule.

A patient who had suffered from a fracture of the patella entered the service of M. Guyon.   There was a fibrous callus 4 ctm. in length.   Functional impotence was complete and considerable atrophy of the triceps with paralysis of that muscle was found.   The muscle was treated by electricity for two months; in the beginning it did not contract at all under the influence of the current, but little by little contractions appeared, became more vigorous, and finally the patient could walk without a limp.   Nay, more, the callus at first 4 ctm. in length, stretched to 6 ctm, though the cure was permanent.   This case appears to demonstrate that the callus had nothing to do with the functional trouble and that its lengthening did not increase the infirmity so soon as the muscle had recovered its power.   M. Larger* exhibited a patient with a callus 12 ctm. long who could walk almost without limping.

M. Picqué gives four observations of these fractures in laboring men with considerable diastasis in each.   In two of these there was no atrophy of the quadriceps, in the two others a very slight withering of that muscle.   They all had good use of the limb.

M. Guyon† had a case under his care where there was a diastasis of the flexed fragments of 7 ctm., with impotence of the member, that recovered perfectly under treatment by electricity.   M. Labonne has collated 13 cases markedly similar to the above.

M. Badin,‡ reporting a fracture of the patella on his own person, stated that while the diastasis increased the func-

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* Societe de Chirurgie de Paris.   Nov. 1883.

† Labonne, loc. cit.

‡ Revue Medicale de Toulouse.   Mai, 1884.

tions of the limb were regaining their power. Treatment by baths and massage had, in six weeks, reduced the difference in circumference between the healthy and injured thigh from 6 ctm. to nothing in some parts, to a single centimetre in others.

M. Guilliot,* commenting on another case in point, said: "That observation well shows how impotence is not in direct sequence to the separation of the fragments, but how it is due for the most part to atrophy of the quadriceps. In this patient the muscles of the thigh are generally little atrophied and still act in their movements by their insertions upon the inferior fragment of the patella and upon the tibia. This fact, then, endorses the opinions of MM. Richelot, Verneuil and Le Fort in the recent discussion in the Société de Chirurgie and condemns the practice of Lister, who makes primitive suture of the fragments."

In the case of P. K., described above, the patient stated that as the thigh gradually approached the other in size, although the separation continually became greater, the limb regained its power. In the case of F. H., the limb has also done well, there being little atrophy of the quadriceps. But the multiplication of examples, as have been given, though interesting, cannot make our case stronger. Besides causing impotence of the leg, M. Verneuil† accuses atrophy of the muscle of subjecting the patient to the danger of new fractures, either from falls or in the effort to avoid these. For when retraction has succeeded to atrophy the rectus becomes a solid, inextensible cord, capable of causing fracture easily. M. Labonne relates a case where the patient, suffering for two years from atrophy, fell to the ground without

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* Societe Medicale de Reims-Seance du 16 Janvier, 1884.

† Societe de Chirurgie de Paris. Seance du 7 Nov., 1883.

striking his knee, and yet sustaining a transverse fracture of the patella.

As treatment for the atrophy, M. Verneuil advises, and has successfully employed, faradization. This is to be begun as soon as the traumatic pain has disappeared, and the fragments are maintained by a simple dressing. Each séance is to last five to ten minutes, and is to be given every two days. Faradization appears to act not only upon the muscle electrified, but even upon the nutrition of the member, as several observers, Prof. Le Fort among others, have noted. The muscles of the leg, as well as those of the thigh, even when only the triceps is thus treated, increase in size. When atrophy has existed a long time faradization is not efficient, and in such cases Dr. Ferras, of Paris,* employs with success the following means: a cold morning bath of twenty minutes, afternoon massage of the limb for half an hour, followed by a douche of luke-warm water.

CONCLUSIONS.

The treatment of transverse fractures of the patella should not be addressed to approximation of the fragments alone—this is but one end among others to be attained. A simple apparatus, such as the Hamilton dressing, is preferably to be employed, since it performs the same service that the suture does without the dangers. It is always better to relieve the articular effusion, when attempting to reduce the diastasis, by vesication or aspiration.

Functional impotence after these fractures is due in general to premature atrophy† of the quadriceps. Atrophy

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* *Revue Med.*, de Toulouse, Mai, 1884.

† At the first French Surgical Congress (Paris, April, 1885), M. Richelot, speaking from a further experience, reaffirmed his views as to the importance of the quadriceps muscle in fractures of the patella.

is constant, but varies in degree. When it is marked, it usually succeeds pronounced arthritis. This atrophy should be combatted by electricity from the beginning.

EDITORIAL.

PHYSICIANS' PROTECTIVE ASSOCIATION.

Attention was called to the importance of establishing a PHYSICIANS' PROTECTIVE ASSOCIATION in an editorial appearing in the January number, 1885, of this JOURNAL. The note was suggested by an eminent surgeon, whose knowledge of the conditions of professional life in Chicago is adequate, and is worthy of reproduction at this time :

The object of the association is to protect physicians from groundless charges of malpractice. It is proposed that all physicians, interested in the subject, unite in the establishment of a fund for the defense, in cases of malpractice, and the elecion of a board of trustees to investigate individual cases, decide on their merits, and secure counsel. This matter is one of interest to every active medical practitioner, and no apology is demanded for calling the attention of the profession to the scheme before it has assumed definite proportions.

The advantages of such an association are obvious. The effect upon the community would be of the most salutary character. We have in Chicago all the conditions for the production of malpractice suits. It is scarcely necessary to direct attention to our large pauper population, native and foreign, the frequent occurrence of all forms of accidents,—in connection with the fabulous number of railroads that center in the city, and the numerous manufacturing industries,—the crowded

state of the legal profession. Within the past twelve months, ten or twelve suits for alleged malpractice have been instituted against as many reputable physicians by pauper patients, backed by irresponsible legal advisers. Not one charge was sustained. The physician, however, has in each case lost time and money, while his professional reputation has suffered from newspaper notoriety. It is an alarming fact that there is not a physician in Chicago of such eminence as to preclude the possibility of indictment for malpractice, at the instigation of a dispensary patient! An organization of the nature indicated would render irresponsible representatives of the legal profession less eager to share the " spoils " with pauper patients.

Such an association would have a favorable influence upon the profession. Medical gentlemen would be more charitable and truthful in their criticisms of the treatment of cases in regard to which they possessed no accurate information.

Many of the recent malpractice suits in Chicago have been instigated by the careless word of a brother practitioner, who had absolutely no knowledge as to the conditions of the case. When moral considerations do not restrain one practitioner from criticizing the treatment of a brother, the laws of the land render it criminal for him to utter a falsehood.

At a meeting of the Chicago Medical Society, Dr. Edmund J. Doering read an able paper upon the same subject, which elicited a spirited discussion. The weight of professional opinion, however, was in favor of a Protective Association. Subsequently, timely and favorable editorials upon this topic have appeared in the *Journal of the American Medical Association*, January 30th, 1886, and the *Medical Record*, February 27th, 1886.

Now that the merits and demerits of the proposed association have been thoroughly discussed, it is time that a meeting of those interested in the movement shall be called.

IPSIS CONSUESCERE REBUS.

We earnestly hope that the suggestion with reference to the appointment of a Committee on Pathological Specimens, made to the CHICAGO MEDICAL SOCIETY by Professor Charles T. Parkes, on retiring from the presidency a few evenings since, will soon receive serious attention.

The importance "of acquainting ourselves, by means of our senses, with the forms, properties and changes of things, in order that the language we employ may, as far as possible, be employed INTUITIVELY," cannot be exaggerated. It is needful to bear in mind Bacon's advice—*ipsis consuescere rebus*—*to accustom ourselves to things themselves.*

The late PROFESSOR JEVONS was in the habit of emphasizing the following paragraph, taken from his "Lessons in Logic:"

"There is no worse habit for a student or reader to acquire than that of accepting words instead of a knowledge of things. It is perhaps worse than useless to read a work on natural history about Infusoria, Foraminifera, Rotifera and the like, if these names do not convey clear images to the mind. Nor can a student who has not witnessed experiments, and examined the substances with his own eyes, derive any considerable advantage from works on chemistry and natural philosophy, where he will meet with hundreds of new terms which would be to him mere empty and confusing signs."

The supply of material for pathologico-anatomical research in Chicago is ample. DR. ELBERT WING, Pathologist to the Cook County Hospital, has expressed his desire to place at the disposal of the SOCIETY the interesting specimens which are inspected at the dead-house.

Society Reports.

Chicago Medical Society.

Stated Meeting, March 1st, 1886.—The President, C. T. Parkes, m. d., in the chair.

Dr. P. C. Jensen read the first paper of the evening, entitled

DIGESTION AND DYSPEPSIA.

The author entered into an elaborate discussion of the physiological processes of digestion, the departure from normal, and the treatment of gastritis, ulcer of stomach and atonic and nervous dyspepsia. Owing to the length of the paper the author was obliged to omit a large portion of it.

Dr. J. Frank thought that in the diagnosis of stomach disease pain under the left shoulder would not be a pathognomonic sign in case any cardiac trouble co-existed. It is well known that patients with cardiac disease complain of pain under the left shoulder. He had found that the majority of cases of dyspepsia are due to dilatation of the stomach and diseases of the pancreas.

Professor C. C, P. Silva spoke of the omission, among the cases enumerated by the paper, of that common form of indigestion due to the excessive use of tea or coffee, especially when the tea or coffee has been boiled for a long time and drank after all the aromatic principles have been evaporated and there is left only the tannic acid, which precipitates pepsin. This is one of the most frequent causes of indiges-

tion with ladies who abstain from cooking much and use
only tea which is not freshly made, with bread and butter,
taking such a lunch frequently.

DR. JENSEN, in concluding the discussion, said that he had
found that in dyspeptic, as well as heart troubles, there is
pain under the left shoulder. It is a symptom of dyspepsia
when other affections can be excluded. As to dilatation of
the stomach, it is often a cause of dyspepsia, and he had
found it especially prevalent with beer drinkers who drink
beer in large quantities, ten to twenty glasses a day. As to
disease of the pancreas being a cause of dyspepsia, it is a
very obscure organ and it is difficult to diagnosticate disease
in it. In regard to long-drawn tea and coffee being an influen-
tial factor in the production of dyspepsia, he had observed
that drinking too much liquid of any kind with the food has
a very deleterious effect upon the digestion ; reducing the
quality of the gastric secretion, and thereby hindering the
proper digestion of the food.

PROFESSOR J. H. ETHERIDGE read a report of

TWO UNIQUE CASES OF VESICO-VAGINAL FISTULA.

In the first case the bladder appeared to be torn across
from side to side about $1\frac{1}{2}$ inches from the meatus urinarius,
and the "flap" thus liberated was hermetically sealed to
the posterior wall of the vagina. The cervix uteri was com-
pletely surrounded with adventitious connective tissue, in
whose meshes was retained menstrual fluid.

In the second case, following a very protracted, severe
labour, wherein the forceps had been fruitlessly used, and
twelve hours later delivery was allowed to be spontaneously ,
accomplished, the most extraordinary results ensued. *The*

*right ovary and uterus had completely disappeared by slough-
ing.* The left ovary remained.

THE PRESIDENT said he thought it a well-established fact
that there is a possibility of an accidental expulsion of the
uterus and its appendages occurring in connection with labour.
During the past year there has been quite a discussion on
the question of whether it is possible for such a thing to
happen, and so far as the extract published in the *British
Medical Journal* goes, it seems to prove that cases do occur
in which, as far as we know, no interference with forceps
or otherwise was made, and yet there was extrusion of the
uterus and its appendages, and sufficient constriction thereof
to produce sloughing and entire loss of these organs.

DR. F. M. WELLER remembered a case in which rupture
of the bladder into the vagina occurred, and the only cause
to be observed was some gravel-stones found in the bladder.
He had no doubt that they were the result of vesico-vaginal
fistula.

DR. R. TILLEY inquired if he had asked the physicians
who attended these cases if forceps were used?

PROFESSOR ETHERIDGE knew nothing of the antecedent
histories of these patients. The first was a Bohemian woman
who spoke German indifferently, and it was difficult to get
her history. The second patient was an American-born
girl, and she gave pretty succinct history of her experience.
She was in labour forty-eight hours, consultation being called
at the end of thirty-six. Instruments were tried but failed
to deliver her, and the physicians gave it up and went home.
Finally pains came on and expulsion of the pelvic contents
took place.

Dr. H. P. Newman read a report of

A CASE OF RUPTURED OVARIAN CYST, WITH SPECIMENS.

Mary H., unmarried; occupation, housework; age, twenty-five; Norwegian. Since her first menstruation, at thirteen years of age, the menses have been regular but scanty, accompanied by severe pain, necessitating her lying in bed the first day of each period. After coming to this country, four years ago, she seemed to suffer less in this respect, and while not strong, enjoyed a fair degree of health. In September of last year she had a mild attack of typhoid fever, convalescing at the end of the second week. During October she gained rapidly in flesh, and experienced less pain than usual at the menstrual molimen, as he afterward learned. In the second week of November following she was taken ill with peritonitis. It was during this attack, which was of several weeks' duration in the subacute and localized form, that his attention was first called to any abnormal condition of the pelvic organs. The tenderness of the abdomen and pelvic viscera rendered a thorough exploration impossible, and it was not until January that a satisfactory examination was made.

The patient first came to his office January 25th, when he found a tumor extending upward and a little to the right of the median line, from the lesser pelvic basin to midway between the umbilicus and symphysis pubis, and corresponding in size and general outline to the gravid uterus at the fourth month. Further investigation revealed fluctuation in the tumor, also that it was detached from the uterus; the latter being crowded to the left and back into the hollow of the sacrum. Although the fluid contents were not examined, the growth was pronounced a probable cyst of the right ovary, and the patient so advised. To any operative procedure the patient demurred,

but promised to consider the matter and report at his office the following week. Nothing was heard from her until February 3rd, ten days later, when he was called to her house at about 6 P. M. He found the patient up, but complaining of pain and soreness of the abdomen, which was slightly tympanitic. Temperature 99½°, pulse slightly accelerated. With the use of an opiate and hot fomentations, the following morning he found her free from pain, with less tenderness over the abdomen, and no tympanitis. Pulse and temperature normal. He enjoined rest in bed, and directed that he should be called in case of further trouble.

On the night of February 6th he was summoned by the message that the patient was very low, and not expected to live through the night. He found the patient at 11 P. M. bolstered up in a chair, in a crouching attitude, with the thighs flexed upon the abdomen. The countenance bore such a pinched and anxious expression as gave striking evidence of grave peril. He was informed that following his visit on Thursday the patient had grown quite comfortable and free from pain, and contrary to his instructions sat up a large share of Friday. In the evening, while reading a letter, still sitting up in bed, she suddenly cried out that something had broken inside the abdomen. She suffered great distress, and was very much prostrated until 2 o'clock A. M., when she became more quiet. From this time she grew weaker, and had a very " bad feeling," as she described it, vomiting at intervals during the day, but suffering no particular pain. He was not called until late at night, twenty-four hours after the accident related. He found a rapid, feeble pulse of 140, skin moist, extremities cool, temperature 99° F., bowels tympanitic, but no pain, and little tenderness. She had passed no urine since the preceding night, and hardly a table-

spoonful of dark fluid could be obtained by the catheter. A digital and bimanual examination revealed no change in the consistency and general outline of the tumor, as far as could be ascertained through the distended abdomen.

The gravity of the situation was explained to the friends, and an exploratory operation insisted upon as the only hope. As immediate consent could not be obtained, he advised a consultation. He thereby met Dr. A. B. Strong at ten o'clock that morning. Through the stimulants which had been freely administered during the night, the condition of the woman remained much the same. Suppression of the urine was still a marked symptom, abdominal tympanitis somewhat increased, temperature normal. The possibility of ruptured pelvic abcess, or intestinal perforation from fæcal impaction was considered, the doctor concurring with me in urging an immediate operation. As soon as arrangements could be made the patient was etherized and placed upon a table. He requested Dr. Strong to perform the operation. The incision through the abdominal wall was about three inches in length, midway between umbilicus and pubis in the median line. As soon as the peritoneal sac was opened there poured forth about three pints of purulent fluid. When this had been washed away, the tumor was readily recognized, filling the entire hypogastrium, its peritoneal surface engorged and discolored by the existing inflammation. Owing to the extensive adhesions, it became necessary to carry the original incision upward and through the umbilicus to a point two inches beyond, and downward to the symphisis. The fundus of the tumor was firmly attached along the under surface of the mesentery, making it

necessary to ligate before removal; and, on closer inspection, a recently torn adhesion was observed, exposing a minute opening in the thinned wall of the sac, through which was oozing the purulent contents. In this connection it should be said that since her former attack of peritonitis the patient had complained of increasing pain on resuming the recumbent posture, a fact now easily accounted for by the extent and nature of the adhesions, which must have been thereby put upon the stretch. It is also probable that while sitting up in bed, movements of the body or abdominal viscera, together with the softening of adhesions by recent inflammation, had produced the rupture here found, and so perceptible to the patient. The complete separation of the remaining adhesions, and the removal of its growth with the right ovary and fallopian tube, was accomplished. The pedicle was tied with waxed silk, the ligature cut short and left within the pelvic cavity. All torn surfaces inclined to bleed were cauterized with a hot iron. The peritoneal cavity was washed out with hot water, dried with clean sponges, the wound closed, leaving a drainage tube in its lower angle, and the abdomen covered with antiseptic dressings.

Notwithstanding the free use of stimulants previously to the operation, and hypodermic injections of brandy toward its completion, within the next hour the woman's pulse became hardly perceptible at the wrist, and her immediate condition critical in the extreme. After the use of further injections of whisky and ammonia, and the application of bottles of hot water to the extremities, the patient rallied slightly and recognized those about her. From nine o'clock

in the evening, however, she gradually sank, and died at eleven P.M. The abdomen was opened the next morning by Dr. Strong and the writer. Though covered with recent exudations of lymph, the peritoneal surfaces were of a better color, nor had bleeding occurred from any of the points of detachment.

The tumor as here presented is a unilocular, dermoid cyst, its purulent contents, about a pint and a half, resembling very much the fluid found in the pelvic cavity. It also contained a mass of fatty substance bound together with a quantity of hair. The right fallopian tube here attached, was uniformly enlarged and held a number of drops of pus. The left ovary, which was removed post-mortem, also contained a few small cysts. The uterus was normal both in size and appearance.

The points of interest are: first, the disparity between the temperature noted and the extreme inflammatory changes in the peritoneal cavity; second, the difficulty in differentiating between rupture of this cyst and a possible pelvic abcess; also the resemblence of the symptoms to those observed in a case of twisted pedicle, as reported to the society by our President, Dr. Parkes, at a recent meeting; and third, the liability of rupture of ovarian cysts even of small size, where inflammation occurs, constitutes additional arguments in favor of early operations.

DR. A. B. STRONG said he believed it was generally supposed by the profession that peritonitis is always accompanied by an elevation of temperature as indicated by the thermometer. He had recently seen a case in which a large quantity of pus was removed by section from the abdomen

of a boy, in which the thermometer did not indicate any rise of temperature. These two cases seem to show that in purulent peritonitis the temperature is not always a practical aid in diagnosis, unless in a negative way.

THE PRESIDENT was inclined to think from some of the symptoms reported that this was a case of twisted pedicle, and that the rupture was caused by the twisting of the pedicle, which is quite often the result of the subsequent distension of the cyst walls; if it is weak at any point, it ruptures. Darkness in color is one noticeable change found in twisted pedicle, and if this was not a case of twisting, there was great resemblance in the symptoms and those of cases he had seen, viz., rapid distension of the abdomen, increased temperature, symptoms of peritonitis, and suppression of urine. In case the ruptured cyst was dependent upon twisted pedicle it might account for the separation of the adhesion, which was found. The mere fact of the movement of the body, which was advised against, might have precipitated a turn of the tumor upon itself, which led to the rupture by a diffusion of blood. He thought it a very interesting case and one calling attention to the necessity of insisting upon early interference in all cases where there is a supposed tumor of the abdomen, accompanied by the symptoms mentioned. And where the operation is done early there is very little difference in the fatality as compared with the operation done without peritonitis being present:

DR. NEWMAN said, in conclusion, that he did not think twisted pedicle was present in this case. The adhesions of the upper part and sides of the tumor were of such a nature that there could be but slight twisting of the base on the

pedicle, and if it had occurred as a factor in separating the adhesions it must have returned to its normal position again, for the tumor, when found, occupied its usual position.

DR. STRONG said he was sure the pedicle was not twisted. There were two points of attachment to the tumor, one adhering to the base of the mesentery on the right side, the other to the sigmoid flexure, both old adhesions, and the points of attachment so located that it would be impossible for the pedicle to be twisted.

THE PRESIDENT wished to know how the dark color was accounted for.

DR. STRONG said that it looked at first very much like a uterine tumor, being thick and vascular. It was a light mahogany color, but was not such a color as is found in a strangulated gut.

PROFESSOR J. H. ETHERIDGE said, in reference to the lack of correspondence between the temperature as indicated by the thermometer and a high degree of inflammation, that the temperature will often be found in cases of peritonitis to be sub-normal. In cases of gonorrhœa in the female, complicated by pelvic peritonitis, physicians are often misled by the fact that the inflammation which produces great pain in the abdomen is not accompanied by a temperature which would lead him to suppose that peritonitis is present, thus causing him to erroneously rule out the possibility of there being peritonitis.

DR. G. W. WEBSTER exhibited a convenient

CASE OF ANTIDOTES FOR POISONS, WITH STOMACH TUBE.

He said that in his limited experience in the treatment of patients who had taken poison, either accidentally or other-

wise, he had often found it difficult to procure the proper antidotes quickly enough and in a suitable form. It was this that led him to devise this case, intending at the time to have only one made for his own use. The case itself contains a pamphlet concerning poisons and their antidotes, a stomach tube, and the following drugs: ether, ammonia carbonate, nitrate of amyl, apomorphia, sulphate of atropia, brandy, camphor, animal charcoal, chloral hydrate, chloroform, digitaline, dialyzed iron, sulphate of iron, tr. of chloride of iron, mucilage, calcined magnesia, sulphate of morphia, iodide of potassium, liquor of potassæ, acetate of strychnia, chloride of sodium, sulphuric acid, tannic acid, sulphate of zinc. The atropia, morphia, apomorphia, strychnia and digitaline have been made up in compressed tablets and combined with soda so that they can be given hypodermically.

Dr. J. Frank exhibited a specimen of

DEGENERATED RIGHT KIDNEY,

with a brief history of the case. Thirteen weeks ago, lithotrity was attempted on a man sixty-nine years old. The lithotrite broke, and the next day lithotomy was performed. The patient did well for about three weeks when he seemed to fail again, and pus appeared in the urine. Then he got better, and the pus disappeared. But a relapse came and he died. During the time he was voiding pus, Dr. Frank had made microscopic examinations to find casts, but was unsuccessful. There was total degeneration of the medullary substance of the kidney exhibited, while the other was full of renal calculi.

The President remarked that the degeneration of the

kidney was so great that tube cast formation would be impossible.

DR. R. TILLEY exhibited a sample of

LANOLIN

which he obtained through favor from Frazer & Co., of New York. He said lanolin has lately been brought prominently before the medical public by the researches of Professor Oscar Liebreich, of Berlin, and its clinical applications by Liebreich and others. The substance exhibited, you will observe, is of a yellowish-brown color, and of a plastic consistency. The upper layer is darker than that immediately beneath. Its odor is slight, but *sui generis*. Liebreich says it should smell like wool. It is found in practically all the keratine tissues of the animal economy, but the commercial article is undoubtedly obtained from wool. The sample he supposed to be a mixture of equal parts of pure lanolin and water. Liebreich calls it a cholesterin fat, that is, a substance composed of fatty acid and cholesterin. The more commonly recognized animal fats being, of course, compounds of fatty acids and glycerine. He promises later to give us its exact chemical composition. The special point of interest about it to us as physicians, is, that it seems to be absorbed by the integument with much greater facility than the substances now in general use as bases for ointments. In the *British Medical Journal* of Feb. 13, 1886, a number of formulæ are given, being so far the result of Professor Liebreich's observations as to the most convenient method of associating it with other substances. He there refers to several clinical cases of interest, psoriasis, favus, and eczema.

He regards it as an excellent base for blue ointment.   He claims that when a small quantity of a sublimate ointment of 1 in 1,000 made with lanolin is rubbed on the skin, that in a few minutes the characteristic metallic taste of mercury appears in the mouth, and from this and other observations concludes that all toxic agents should be used, when associated with lanolin, with great caution.

Stated Meeting, March 15th, 1886.—THE PRESIDENT, C. T. PARKES, M. D., in the chair.

DR. ROBERT H. BABCOCK made remarks on

TWO CASES OF MITRAL STENOSIS,

with presentation of the patients.

DR. BABCOCK said that he did not intend to give any discussion of mitral stenosis, but merely desired to present a few points of interest in connection with these patients. Mitral obstruction is due to a fusing together of the valves so that they project into the ventricle in the form of a funnel, which, according to many authors, is the most frequent form of stenosis; according to others, the obstruction is due to a septum-like valve stretching across the opening, and called the diaphragmatic valve.   Owing to the obstruction to the flow of blood from the auricle into the ventricle a murmur is produced, which is rolling or blubbering in character, and occurring during the auricular systole and previous to the systole of the ventricle, is called pre-systolic or auriculosystolic.   This murmur has been graphically represented by Balfour as in some cases resembling the sound of voot-rrrb,

the final t or b being the sudden, abrupt first sound produced by the ventricular systole.

In some cases no pre-systolic murmur, correctly speaking, is heard, only a diastolic murmur, which, being loudest at the apex in the mitral area, is a mitral-diastolic murmur. This murmur should be differentiated from the diastolic murmur of aortic regurgitation, which, in certain rare cases described by Balthazar Foster, has its maximum of intensity in the mitral area and not at the centre of the sternum.

In the two cases Dr. Babcock presented the murmurs differed from each other in character, in the one case the murmur being very distinctly represented by the letters voot, in the other by rrrb. The doctor was disappointed at the last moment by his inability to present a third patient, a man in whom the stenosis was indicated by a mitral-diastolic murmur which followed an impure first sound of heart, and both the impure first sound and the diastolic murmur were in this case audible at the lower angle of the left scapula. The propagation of the diastolic murmur so far to the left is very unusual; indeed, the production of the mitral-diastolic murmur is itself very rare, and is probably due to the fact that a rush of blood from the left auricle to the ventricle occurs with greater force at the beginning of the ventricular diastole than during the auricular systole, the auricle being dilated rather than hypertrophied, according to Sanson. The cases were then examined by members of the Society.

PROFESSOR E. C. DUDLEY reported a

UNIQUE CASE OF VESICO-VAGINAL FISTULA,

in which the entire vesico-vaginal septum, the vaginal portion of the cervix, and anterior wall of the cervix to the internal

os had sloughed away, leaving no bladder tissue between the inner extremities of the urethra and the points at which the vesico-uterine ligaments connect the bladder with the uterus. The only operation which seemed possible was to unite the posterior wall of the cervix uteri with the neck of the bladder. This would turn the uterus into the bladder and necessitate menstruation through the urethra. The anterior wall of the uterus could not be approximated to the neck of the bladder, but it was found, on further examination, that the mucous membrane of the bladder, if caught with the tenaculum about an inch in front of the uterus, could be drawn to the neck of the bladder and held without undue traction. The operator therefore undertook to close the fistula in this way by denuding a strip of the mucous membrane of the bladder from side to side an inch in front of the uterus, and thus he utilized that portion of the bladder between the line of denudation and the uterus, and made it a substitute for the lost anterior wall of the cervix and vesico-vaginal septum. Twenty-two silver wire sutures were employed after Sims's method. Union by first intention followed, notwithstanding the failure of the nurse the third day to keep the catheter *in situ*, which allowed several ounces of the urine to accumulate in the bladder. Notwithstanding the decrease in the size of the bladder necessitated by the operation, the patient experiences no difficulty in retaining the urine all night. The operator is not aware that another case of this kind has been previously reported.

THE PRESIDENT asked if it was not possible that some portion of the upper wall of the vagina was drawn upwards and backwards by the bladder, and what was taken to be a continuous wall of the bladder might be a part of the vagina. He

had seen a case where there was a large laceration into the bladder, and the opening seemed one cavity with continuous walls, but the flap thrown backwards was post-vaginal, and it was found that this flap could be drawn up and into its position.

PROFESSOR E. C. DUDLEY, in answer to questions, said that the loss of tissue at the base of the bladder from sloughing differs from that by incision. In the latter case the uterus would perhaps be included in the excised tissue, but it is seldom that a slough of the base of the bladder in the vesico-vaginal fistula, however extensive, destroys the connection between the bladder and kidneys. Even if the points through which the uterus penetrate the mucous coat of the bladder be lost, it is yet possible their openings into the bladder may be preserved, because the uterus penetrate the muscular coats nearly an inch from their normal points of opening through the mucous coats of the bladder, and run obliquely between the two coats for a distance of nearly an inch. In this case, as in many cases of loss of entire base of bladder, reported by Emmet, the openings of the ureter were on either side, at the very margins of the fistulous opening. The operation was performed at Morton, Ill., in the presence of Dr. Harris, of that place, and Dr. Mansfield, of Metamora. Dr. Parkes's surmises with reference to the vaginal wall could hardly be correct, because this, together with the anterior wall of the cervix uteri up to the internal os, had sloughed away. His surmise might be correct with reference to certain tissues between the bladder and cervix uteri, which might have retracted and become adherent by inflammation, so as actually to form a portion of the bladder wall. Moreover, there is always a very decided difference in color and appearance between vaginal and bladder tissue, and the tissue in this case was to all appearance like

the tissue of the rest of the bladder, and to the touch gave the sensation of a thin wall.   Dr. Baker, of Boston, reports a case similar to this, in that he introduced sutures into the bladder tissue, but so close to the cervix uteri as not to draw down any portion of the interior of the bladder, to be used as material in place of the lost vaginal wall.

Dr. W. L. AXFORD reported

A CASE OF REMOVAL OF THE ENTIRE LOWER JAW THROUGH THE MOUTH.

Harry T., aged five.   Admitted to St. Joseph's Orphan Asylum in November, 1885.   It was noticed that his mouth was frequently swollen and sore.   Child very much emaciated. In January, 1886, he had measles.   Tedious convalescence followed.   Came under observation about February 1.   Weak and thin.   Lower part of face very much, swollen.   Breath offensive.   Symphysis of jaw bare.   Could not examine further at this time.   Pulse 120 to 130.   Put the child on supporting treatment, hoping to get him in condition for an operation. No improvement at the end of two weeks.   February 16 the patient was anæsthetized and the mouth explored.   Found the jaw on either side stripped of its periosteum back to the masseters.   Determined to attempt removal through the mouth, as any culling operation involving the loss of much blood would have been fatal at once.   Divided the jaw on either side of the symphysis with bone pliers and thus removed a large portion of the body.   Seizing the remaining pieces with sequestrum forceps and making moderate traction, they were easily enucleated by the index finger of the left hand.   Not more than a tablespoonful of blood was lost.   Patient rallied well. Some reaction on second day.   On third day the pulse had

dropped to 116, and with exception of a swollen parotid on the left side, the child was in better condition than before the operation; so much so that a recovery was confidently predicted. A severe attack of diarrhœa occurring on the morning of the fourth day was followed by death in thirty-six hours.

DR. ARNOLD P. GILMORE exhibited a patient on whom he had performed an operation for

SYMBLEPHARON OF THE LOWER LID,

due to a burn by molten iron, and in which three plastic operations had been unsuccessfully performed. Nine months previously the entire lower lid, from external to internal canthus, was adherent to the eyeball, covering almost the entire cornea. This triangular-shaped tissue was covered by a pale membrane of cicatricial tissue. The operator first detached the lower lid and transplanted the conjunctiva of a rabbit. For six weeks the operation was apparently successful, but after an absence of two months from the city he found the lid was again becoming adherent. Six weeks previously Dr. Gilmore made a thorough dissection, freeing the lid and making a deep cul-de-sac, leaving the upper half of the eyeball covered by mucous membrane and the lower half bare. A semi-circular band of conjunctiva, one-third inch wide, was dissected close to the cornea above, leaving a bridge of tissue at each end. This band was dropped into the cul-de-sac below and carefully stitched to the ball. A semi-circular plate of silver, long enough to fill the space between the external and internal canthi, with two holes at the circumference, one-half inch apart, threaded with silver wire, was dropped into the cul-de-sac to prevent adhesions, and

fastened by bringing the wires through upon the face and fastening them by small lead plates and perforated shot. For this operation Dr. Gilmore claimed priority. The object of the operation was neither to improve the appearance of the eye nor to restore vision, but to relieve the irritation of the other eye, by allowing coördinate movements of the two eyes. There was enough clear cornea left to make an artificial pupil in case the patient ever lost his well eye. There was little reaction, and at no time much pus, while the well eye has grown stronger in spite of the presence of the plate.

DR. TILLEY thanked Dr. Gilmore for showing this case, but thought that if the Doctor were to go out of town again for two months, as in the first instance, he would find at the expiration of that time the conditions relatively very much the same as on his return after the first operation. He thought there was little fundamental advantage likely to be associated with the operation, as he thought that in a short time the wire and plate would cause a certain amount of atrophy of the intervening tissue and the plate be forced up out of position, making the operation of no avail. If he was so unfortunate personally as to be placed in a similar position, he would have his eye enucleated.

PROFESSOR E. L. HOLMES thought it unwise to say that a certain thing could not possibly be accomplished, but he had been through the experience of putting in plates, and seeing it done, and never saw one permanently successful. It is different with a very narrow symblepharon in which the globe and eyelid are grown together, where by dissection and transplanting the mucous membrane excellent results may be attained. He thought the plate would irri-

tate the cicatricial tissue and cause it to be very much thickened, and after a few months, or weeks even, when everything is removed, there will be the same tendency to creep over the cornea and make adhesions with a broad union. He thought it absolutely impossible to get an artificial eye to fit. A very small eye might be used and temporarily make it appear that the patient was better off, but that small eye will often irritate and cause the cicatrix to increase.

THE PRESIDENT thought this case one of the same category that is so troublesome to the general surgeon, the improvement of deformities from cicatrices of all kinds, in which relief comes only in the way that Dr. Dudley has applied in gynæcology, after the divided cicatrix has been separated as widely as possible, by drawing together the healthy skin or tissue between the two ends of the divided cicatrix. This method has long been in use in general surgery. So far as his experience went, the application of any foreign body between these divided surfaces has never been followed by success, so far as prevention of contraction goes.

THE PRESIDENT presented an

ENCAPSULATED SARCOMA OF THE THIGH.

It had been in alcohol for some time, and was reduced about one-third in size. It had grown the full extent shown in three months, and was removed from an old lady aged sixty-nine. It was found growing upon the posterior part of the upper portion of the thigh; was a firm, smooth tumor to the touch, and as far as external manipulations determined could not be distinguished positively from other parts of the surrounding tissues. He could not determine whether it was or not attached

to the bone, but from external appearances it was diagnosticated to be of a malignant type. The external surface was crossed by a large number of varicose veins. After removal it was shown to be a sarcoma. The interesting point was the rapidity of its growth. He thought it a singular coincidence that about a year previous he had removed a similar tumor from the upper portion of the left arm of an old man of seventy-two years, which had also grown to the full size in three months. Upon exposing the tumor a perfect capsule was reached, and it was easily enucleated from its bed.

BOOK REVIEWS.

THE MANAGEMENT OF LABOUR AND OF THE LYING-IN PERIOD. A GUIDE FOR THE YOUNG PRACTITIONER. *By* HENRY G. LANDIS, A. M., M. D., *Professor of Obstetrics and Diseases of Women in Starling Medical College, etc. 12 mo., pp. viii., 334. Philadelphia:* LEA BROTHERS & Co., 1885. *Chicago:* JANSEN, McCLURG & CO.

The aim of this little volume is to serve as a guide to practice, divested of all superfluous or irrelevant details. The author desires " modestly to say to the physician ":

" Let this not lie unread upon the shelf, unless you know some better way yourself." The design of the book is certainly good. But the American press is prolific of such

books,—some of them very excellent treatises. The practitioner justly demands of the author by what authority he doeth these things. Unless the author can meet this challenge, he is presumptuous to offer a new book to the profession. Let us accordingly inquire as to the "manner, skill, and ability with which the design has been carried out."

In the chapter on " The Normal Standard," the writer asserts that in ideally normal labour there is no pain, or but little, and that six hours represent the maximum limit of normal parturition. In the discussion of the diagnosis of presentation no allusion is made to abdominal palpation. Dr. Landis says the great objection to frequent vaginal examinations is that the finger is apt to withdraw each time some of the lubricating mucus from the vagina. The freedom with which the author advises digital dilatation of the *cervix uteri*, and his suggestions with reference to the care of the perineum, evinces an utter disregard of principles of treatment definitely established early in this century. The cord must be tied as soon as the child cries! The author usually " Credé's the placenta!" " There is no reason why we should not use the verb *to Credé* as simpler than the periphrasis 'to use the method of Credé.' " It is recommended that within a few hours after the termination of labour, the woman " sit upon a chamber placed in the bed and try to urinate." " In puerperal eclampsia," says Dr. Landis, " the temperature increases with each convulsion, and in fatal cases may reach 100° F. or 109° F. In uræmia the temperature falls and may be subnormal."

In the chapter on pelvimetry, we are informed that " external pelvimetry is of no use in an individual case." It is needless to multiply examples of grave errors both as to fact and opinion. There is scarcely a single page which does not abso-

lutely condemn the treatise.   The mode in which the design
of the work has been carried out is hopelessly bad.

An eminent obstetrician recently said to an acquaintance,
" The practice of midwifery in the United States is rapidly
becoming one of the lost arts."   If the little volume before us
be regarded as a fair exponent of the practice of obstetrics in
the United States, we would be compelled to adopt the opinion
of our pessimistic friend.   We are under the impression, how-
ever, that the author's views and methods of practice are
peculiarly his own.

THEORY AND PRACTICE OF OBSTETRICS.   *By* P. CAREOUX *and*
S. TARNIER.   *Edited and revised by* ROBERT J. HESS, M. D.,
Philadelphia.   Octavo, pp. xxxii., 1081.   Philadelphia : P.
BLAKISTON SON & CO.   1885.   *Chicago :* W. T. KEENER.

Cazeaux's "Obstetrics "—a justly popular text-book in the
United States some years ago—possesses now the historical
interest to which as a classical work it is entitled.   The addi-
tions and revisions of Professor Tarnier fail to bring the book
up to the standard established by recent publications on the
same subject in the English, German and French languages.

A similar remark is applicable to the editorial labors of Dr.
Hess, although the value of the work is enhanced by his very
readable chapter on puerperal insanity.   The chapter on lacer-
ation of the perineum is entirely superfluous.

Due credit is nowhere given to Schroeder, Braune, Bandl
and others for the free use of their plates and figures.

The book is essentially an old one.   The recent anatomical
investigations of the *cervix uteri*, during pregnancy and labour,

Professor Lahs' theory of labour, the results of late researches into the nature of eclampsia and puerperal fever, and the like, are conspicuous by their absence.

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THE ESSENTIALS OF HISTOLOGY, DESCRIPTIVE AND PRACTI-
CAL, FOR THE USE OF STUDENTS. *By* E. A. SCHAFER,
F. R. S. *Jodrell Professor of Physiology in University
College, London; Editor of the Histological Portion of
Quain's Anatomy. Philadelphia:* LEA BROTHERS & CO.
1885. Chicago: W. T. KEENER.

This book is intended as a working manual for the laboratory as well as a text-book on histology.

The methods of the study of the tissues, though not in every case the best possible, are all good, and above all practical in laboratory teaching.

The histology is founded upon the second volume of Quain's anatomy, written by the same author. Those who are acquainted with Quain will expect a high grade of performance here, nor will such expectation be disappointed. The author seems to have recognized the fact that in a work of this kind it is his duty to give the state of the science as it is received by the best authorities, and not to air his own notions. This aim he has adhered to, admirably. A significant difference between the descriptions of the white blood-corpuscles in this volume and that in Quain, will illustrate. In Quain, Klein's figure of the network in the white corpuscles is reproduced and endorsed. In the present volume the

figure is absent, and all he says is that " articular structure is described by some histologists." He seems doubtful of the facts. This conservatism as to theories does not prevent his accepting new facts promptly, as may be seen in his description of a villus.

But no human work is perfect. He has not seen the eminence in the centre of the red blood-corpuscles, called by some a nucleus, though he mentions it, probably because he will not use the proper illuminating apparatus, very likely regarding all such things, in common with so many other histologists, as playthings.

He gives the number of the red corpuscles in a cubic millimeter of blood as from four to five millions, although the best authorities say the number is at least a million more.

Perhaps the most careless part of the book is on the kidney. In a table of the course and position of the tubules with the character of their epithelium he says the " epithelium of the convoluted tubule is cubical, fibrillated, ciliated," etc. In the text he says that " in many animals " these cells " have been shown to be ciliated." He does not state, however, that the cilia have been found in the *neck of the tube only*, where it passes out from the malpighian capsule and that it may be the remains of a fœtal structure, and is not always present in these animals. The cilia are found in the tubes in the lowest animals only, such as birds and reptiles that have solid or viscid urine. They have never been demonstrated in any part of the kidney in man and most of the higher mammals. It would seem to be a matter of no such extraordinary difficulty to find them with the modern methods, if they really are present, when they can be shown

in the central canal of the spinal cord with such comparative ease.

One who was critical might find other places not faultless, but occasions for censure are rare.   On the whole, the book is excellent, and supplies a want, there being no histology in the market adapted to the wants of the student except, perhaps, Quain; but for most students Quain is out of reach.   L. C.